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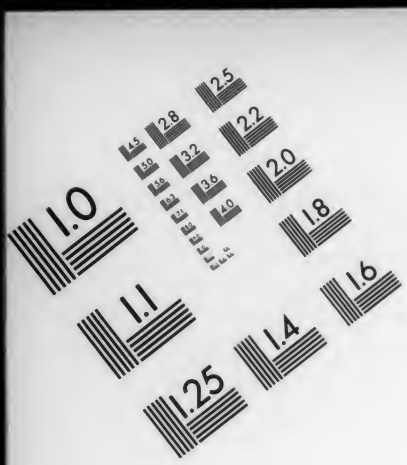

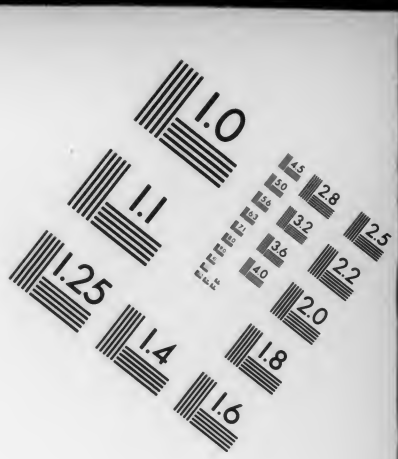

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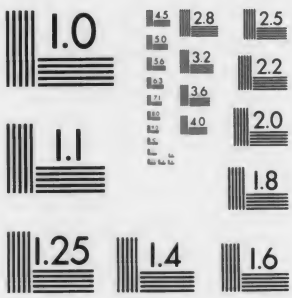

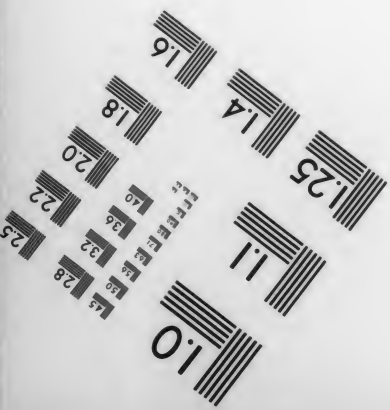

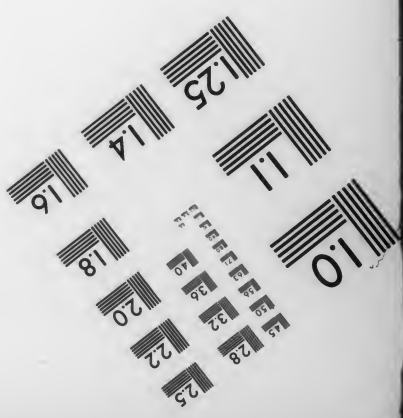

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AN HISTORICAL AND CRITICAL EXAMINATION OF ENGLISH SPACE AND TIME THEORIES FROM HENRY MORE TO BISHOP BERKELEY

BY

JOHN TULL BAKER

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY
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CHAPTER I

INTRODUCTION

The purpose of this essay is the examination of those theories of space and time which were current in England from 1648 to 1744. The first date acquires significance because in that year Henry More dispatched his first letter to Descartes. The second date is of no less importance since it marks the publication of Berkeley's *Siris*. The years included between the first serious philosophical work by More and the last by Berkeley represent one of the most fertile periods in the history of English philosophy and science. It is the age of Newton and Locke and Berkeley, an age in which the relation between science and philosophy was most apparent and in which each was seriously determined by the work of the other. Furthermore, it was a period of intense religious and political discussion, often directed in such a fashion that important connexions are discernible between this second set of disciplines and the former.

If it is necessary to pick out some one predominating interest in the majority of the men to whom we shall refer, that interest would today be called scientific. In this sense, the *Principia* of Isaac Newton gives to these years, in so far as questions relating to space and time are concerned, the most characteristic intellectual stimulus. The English speculations on space and time before the publication of the *Principia* strongly influenced Newton. The *Principia* and its theory of science continually directed and motivated subsequent philosophers and theologians. From this point of view we may detect two slopes. On the first of these, leading to Newton's work, we find More, Barrow, and the other Cambridge Platonists. On the second, leading from the *Principia*, are Keill and MacLaurin, Locke and Berkeley, Clarke and King. From this list two names of great importance for the history of English philosophy have been omitted. Hobbes and Hume, although both were writing during this time, do not find a place in our considerations. It is quite true that we may read the works of Henry More as a continual protest against much that Hobbes said, but in so far as space and time are in question More begins and continues his work as a criticism of Descartes. It is difficult to see that Newton and English science, with its resultant philosophy of space and time, owes much if anything to Hobbes speculations. The current of science is from Galileo to Newton and in this tradition Hobbes does not find a place. The most noticeable exception to these statements is found in Locke's early work. Here the position that Hobbes adopted receives some reference.[1] From Hobbes we learn that space is to be defined as:

> "The phantasm of a thing existing without the mind simply; that is to say, that phantasm, in which we consider no other accident, but only that it appears without us."[2]

[1] King, Locke's *Journal* for 1676.
[2] Hobbes: *De Corpore*, edited by Molesworth (London, 1839), Vol. I, p. 94.

Although such a statement raises many problems it is of interest to us as an attempt to arrive at a theory of space different from that of Descartes. As we shall see, More is to attempt something quite similar in so far as space is made distinct from body. But even so, More anticipates Hobbes by at least seven years[3] and develops his change in a way that is to be influential for English philosophy. Even with Locke, Hobbes's theory is but of temporary interest and is considered only to be abandoned. In his theory of time Hobbes repeats the position of Aristotle that:

> ". . . time is the phantasm of before and after in motion; which agrees with this definition of Aristotle, time is the number of motion according to former and latter; for that numbering is an act of the mind; and therefore it is all one to say, time is the number of motion according to former and latter; and time is a phantasm of motion numbered."[4]

This opinion for our purpose is of interest solely by contrast. Without exception we shall find that no one during this period refers to this theory but to conclude that it is untenable. Time is to be understood either as a real entity existing in its own right or else as the flux of our ideas.

The relation of Hume to scientific thought is comparable to that of Hobbes in many ways. The development subsequent to Newton is chiefly in the work of Locke and Berkeley. That Hume has a place in this development is undeniable. However, for our study the contributions that Hume makes to theories of space and time are omitted as not of sufficient difference from the theories of Berkeley.

In addition to the important position filled by Newton's *Principia* there is the contemporary importance of Locke's *Essay* as the systematic account of the limits and extent of knowledge in a Newtonian world. It is quite possible to take the *Essay* as the culmination of a series of traditions leading to it and as the starting point for another set of traditions leading from it. Such an interpretation of this period places more emphasis on theories of knowledge than on theories of space and time. Consequently, in writing of this period Newton's work affords the more important center around which to group our investigations.

By viewing the period according to this plan we acquire a fairly simple approach to Henry More. To More that which seemed most certain in the philosophy of Descartes was the geometrical and spatial account of matter. More is quite ready to accept such an account if he may make certain changes and additions. Of greatest importance is the attribution of extension to spirit and a fundamental change in the definition of matter. Putting this in other terms, we may say that More regards the scientific attempts of Descartes with great favor, so much favor in fact that he believes it is only necessary to amplify the account in order to make it satisfactory to his own needs and beliefs. In order to do this, More develops a theory to show that the spiritual or immaterial, in possessing space and time as attributes, may be considered at least as real as the material elements of the Cartesian physics. But in this attempt, More introduces into English philosophy absolute space and time.

[3] *De Corpore*, 1655; More's 1st letter to Descartes, 1648.
[4] Hobbes, *De Corpore*, p. 95.

At the start then, we shall find that English speculation acquires absolute space and absolute time as the result of More's additions to and changes in the Cartesian philosophy in so far as this philosophy attempts a scientific account of natural phenomena.

Almost at the same time as the work of More are the mathematical researches of Isaac Barrow. In these, we shall find further developed More's theory of time although there are certain rather fundamental changes of great importance which are to find expression in Newton. Again, the works of More and Barrow had another emphasis which is of more particular interest to theology. More was especially concerned with proofs for the immaterial and in this connexion his treatment of absolute space and time set for contemporary theologians certain problems which absorbed much of their efforts.

If it is true that in More we find variations from the Cartesian physics this is even more obvious in Barrow so that for the preparation of the *Principia* Newton is afforded a certain definite divergence from Continental models. In addition to the theories of absolute space and time which by now are current in England and which have been given a scientific meaning by Barrow in contrast to the spiritual interpretation of More, there is an atmosphere of distrust of the Cartesian definition of matter as the extended. This distrust seems to originate in the criticism of Descartes by More when the latter was making clear the claims of the immaterial. It is less surprising, then, that Newton returned to the physics of Galileo for a definition of matter which would allow him to define matter as mass. Placing now his own definition of matter against the background of More's and Barrow's theories of space and time, Newton develops to his own ends the theories of space and time found in the *Principia*. But there is another influence at work within the *Principia*. Although Newton adapts the definition of Galileo for matter this matter is just as absolute as the matter of Descartes. In spite of differences in the two physics from which Newton might choose they agree in the assumption that body in its own nature is absolute and unchanging. Consequently, the *Principia* affords at least two points from which to begin an interpretation. In the first place, there is the historical background in England of absolute time and absolute space implying sharp criticism of Descartes. Secondly, there is the possibility of a logical development of space and time theories from the initial assumption of absolute matter, an assumption common to the physics of Galileo, Descartes, and Newton. Read in this light, the *Principia* shows other relations to the history of English philosophy for it is possible to assume that Newton would have deduced absolute space and time even though such theories had not been suggested by his Cambridge associates. To adopt one interpretation at the expense of excluding the other does violence to the facts. They are not contradictory either in themselves or in the light of other works by Newton. Both the *Principia* and *Optics* consider absolute space and time God's attributes like More and Barrow. Any reading of Newton must give some due to both interpretations since there is reason to believe that Newton might well have been aware of what was implied and what was, in a certain sense, borrowed.

However, Newton's theories of space and time are not restricted to an examination of these as absolutes. There is the further question of relative time

and relative space or time and space as measured. This is a question that originates in Barrow rather than in More and reflects most clearly the points of view from which the former approached the problem and the reasons why the problem was approached at all. In the question of measurement of time and space we find how time and space were treated by English physics. And at the same time, it is in this question of measurement or knowledge of time and space that is revealed the obvious point of departure to Locke's *Essay*.

Locke's *Essay* is to be regarded for this study as an attempt to make clear the limits and extent of knowledge once the world as described by Newton's physics has been postulated. In this sense, Locke's *Essay* is a theory of knowledge and for our purposes a theory of how we can have knowledge of the space and time, both absolute and relative, that Newton considers necessary for his system of absolute masses. In the first place, the *Essay* must account for a space and time in which the absolute Newtonian masses are located. This is the space and time of scientific objects which are postulated as the cause of ideas. In ideas we have Locke's second class of entities which he considers adequate to cover that which the mind knows. They are caused for the mind by scientific objects which are in absolute time and absolute space. But of such space, time, and objects the mind is never directly aware, only aware of the ideas which have reference to this external world. The system of ideas constitutes our system of knowledge and corresponds to what Newton might have meant by measurements. We find Locke providing a place and a time for this second set of entities, a place and a time which correspond closely to the relative space and relative time of Newton's physics. Here we see reaffirmed in Locke's theory of knowledge the metaphysical foundation assumed by Newton. There is a real world of absolute masses of which we have various measurements more or less exact. Of these measurements knowledge is constituted, e.g., relative time and relative space which are in some sense approximations to real time and real space. If we change the terminology from measurements to ideas we see the connexion of Locke's theory of knowledge with the world of physics. Furthermore, there is noticeable in Locke the same theological implications of absolute space and time as we have noticed in Barrow, More, and Newton.

As we said before, it is feasible to regard the *Principia* and the *Essay* as representing the two dominating influences in the period under discussion. The first has described the system of nature while the second has explained how that system can be known. But also we shall be called upon to consider the relation of this system and our knowledge of it to the nature of God and our knowledge of God. From the beginnings of our study it will be necessary to take account of the continual reference of absolute space and time to such attributes of God as His extension and duration. The period from 1731 to 1734 is of particular interest in this connexion. During these years the discussion is unusually vigorous concerning the validity of such an identification. In a measure the basis for the discussion begins somewhat earlier (1705) in certain statements by Samuel Clarke in his Boyle lectures. But it was not until Edmund Law published his translation of King's *Origin of Evil* (1731) that serious issue was taken with the tradition established by More. From this time

until 1734 many pamphlets were written in defense of both points of view, Locke serving as an authority for both sides. Although the immediate point of dispute involves certain theories of space and time and God's attributes, the controversy has a larger setting. Briefly, this seems to be a difference of opinion concerning the advantages and disadvantages that result for religion when religion attempts to harmonize its beliefs with the beliefs of science and philosophy.

From this discussion we must turn to Berkeley in whose work we find the culmination of our investigations of the English theories of space and time from 1648 to 1744. In reading Berkeley a double approach has been chosen. In the first place, it is necessary to consider the presuppositions of Newtonian science. As we have said and as we shall see later in more detail, this science bases its hypotheses on matter defined as mass. To a criticism of this definition Berkeley directs much of his work, and for our purposes to a criticism of the absolute space and time which is the locus of this matter. Secondly, we must recall Locke's theory of knowledge and the definition of idea as that which is alone immediately known yet has reference to the system of scientific objects. It is in the examination of these assumed scientific objects that Berkeley established his connexion with Locke. It will be necessary for us to regard Berkeley's theories of time and space as they arise from these two standpoints. In his relation to Locke, Berkeley's work is to reveal that from the very definition of idea idea alone is knowable so that the only intelligible time and space is relative time and space. In this conclusion we discover the trend of his divergence from Newton. Matter as absolute mass and space and time as the locus for this matter are likewise unknowable; our knowledge is limited to the objects of perception, to the space and time which are perceived. But this does not complete the philosophy of Berkeley. God has a place and of the existence of God we can be just as certain as we are certain of our ideas. Furthermore, there is a relation between our ideas and God's Ideas, so that at the end of Berkeley's philosophy there is strong reason to suspect that in the knowledge that God has of time and space we see occurring once more the absolute time and absolute space of Newton and Locke.

Such, in brief, are the major characteristics of the material included in this essay. It is the purpose of the subsequent chapters to treat the questions raised here in greater detail. Only in this way, it is believed, is it possible to make clear the issues involved and the setting in which these issues were at one time of the greatest interest and importance.

CHAPTER II

HENRY MORE

In the work of Henry More (1614–1687) we discover a remarkable contrast to the speculations of Descartes, a contrast in fact which is to have important implications for the subsequent history of English Philosophy. It is reasonably safe to say that in More we meet but another transitional figure, transitional in the sense that any philosopher may well be who finds an integral and intimate place in the living and influential work of his period. However, it is not sufficient to leave the case with this conclusion for the speculations of Henry More are of sufficient novelty and complexity to have an interest of their own, as an effort to provide definite answers to two at least of the most difficult of philosophical problems. Because of this we find his work starting with a critical examination of Descartes, continuing as a vigorous protest against materialism, and in its conclusions containing material that will prove to be important for the physics of Newton and the theory of knowledge of Locke. Let us then examine, first, More's arguments and conclusions regarding space and time, reserving for later consideration the implications of these answers as they appear beyond the scope of his work in the thought of his successors.

A survey of More's writings reveals a life-long interest in the nature of space, an interest that finds expression at least as early as 1648[1] and again as late as 1684[2]. In this period of nearly forty years the space problem never fails to interest More, although, at no time could it be said that the end of his work is solely to untangle the ramifications of this problem. The difficulties pertaining to an understanding of space and time are merged with the problems related to a subject of far greater importance and interest for More, a subject with a history as long or nearly as long as the very history of philosophy, the question of mind or spirit.

In the tradition which roughly may be said to have been founded by the Anaxagorean *Nous*, further developed by Plato, Plotinus, Augustine, the philosophy of the Middle Ages, and the Platonizing tendencies of the Florentine Academy, More finds a place and is at home. To give to mind or spirit as individualized in man or as unified in a soul of the world or God indubitable and certain reality is the major purpose of all More's efforts. That More presumes he has discovered in the nature of space a means for the realization of his project lends an unusual piquancy not only to his arguments touching on space but to his philosophic temperament as a whole. Let us begin then an examination of More's account, postponing for the moment the consideration of why space is chosen for the important task of proving the reality of spirit, since

[1] Correspondence with Descartes. *Oeuvres de Descartes*, pp. Cousin (Paris, 1825), t. 10, p. 184.

[2] Correspondence with Norris. John Norris, *Theory and Regulation of Love*, 2nd ed. (London, 1694), p. 128.

this question requires a return to the thought of his contemporaries and a consideration of the peculiar contrast mentioned above between the Neo-platonic purport of More's speculations and the philosophic import of the new science.

A classificatory division of More's presentation of space gives two parts. In the first place, there is the set of proofs which are intended to show that space is existentially real. Secondly, there is another series of proofs depending on and growing out of the previous set which are designed to make clear the intimate relationship between the previously determined attributes of space and the attributes of God. However, this division cannot be pushed too far without involving us in a rather misleading interpretation of More suggesting a meticulous preciseness hardly to be discovered in More's writings. Throughout most of the sections relevant to a discussion of space there will be found badly confused the nature of space as such with the nature of God's attributes.

An examination of the correspondence between More and Descartes[3] in the years 1648–1649 shows More strongly protesting against the Cartesian postulate of a plenitude of matter as well as against the void of the Greek atomists and Lucretius. To the suggestion[4] of Descartes that if a vase were emptied of the air or other bodies contained within it, its sides must necessarily collapse, More make two replies. First, the vessel will not necessarily be destroyed because of the vacuum formed by the removal of its contents, for if it is true that the Cartesian matter receives its motion from God, it is equally true that matter (in this case the walls of the vessel) might receive a counteracting motion from God which would preserve the form of the vase.[5] It is logically within the power of God either to create or preserve a vacuum. But More is not content to leave the question here. Without warning or previous preparation we are told, in a bold assertion, that although God has provided for the possibility of vacuum, a vacuum (in the example given above) will not occur, for after everything whatsoever has been removed from within the vessel, there still remains the "divine extension."[6] This extension given to God is real, just as real as the extension attributed by Descartes to matter. For this reason, the walls of the vase are not to be considered as approaching each other from "absolute necessity"—this is obviated by the will of God. If the walls of the vessel approach each other at all it can only be because God permits it.[7] Exactly what meaning this passage has, when it is recalled that the will of God is absolute and the presence of God really extended, it is rather hard to understand. Presumably, there is a vague intention to crystallize in God all motivating power, all will, and insist once again on the Neo-platonic doctrine of the passivity of matter. But yet another difficulty arises because of the presence of the "divine extension" within the evacuated vessel. In giving to God real extension More quite well realizes that he has conferred upon God the same test of reality that Descartes had ascribed to matter. The problem thus becomes, has God, in partaking of that which Descartes holds to be the essence of matter, become material? In the second letter to Descartes (March 5, 1649) More attacks this possibility by

[3] pp. Cousin, *Oeuvres de Descartes* (Paris, 1825), t. 10.

[4] *Op. cit.*, p. 184.

[5] *Op. cit.*, p. 184.

[6] *Op. cit.*, p. 184.

[7] *Op. cit.*, p. 184.

mentioning two distinctions applicable to the divine nature. In the first place, His entire essence is present in all places or spaces since the essence of God may enjoy unlimited multiplication and appear equally real both within and without the world. From this it follows, that to speak of the divisibility of God's extension is not to mention in analogous fashion the actual division of matter. The presence of God first at A. and then at B. does not make God corporeal, for unlike a portion of matter, God is complete and whole both at A. and B. at the same time.[8] Unlike Aquinas, More will have God not only present as power to act but also actually present; the essence of God pervades all places at all times, enjoys the same reality of extension as matter, yet is not material.

In an appendix (1655) to *The Antidote Against Atheism* More involves himself in a second aspect of his space problem which grows out of the supposition previously advanced in his letters to Descartes. If it is contended that space is extended in all directions and is measurable by some choice of units, then it must follow that space is some definite entity, for if it were nonentity how could it have the property called measurability?[9] But if it is an entity what else can space be but matter? Imagine, More replies, that there is no matter whatsoever, only the unbounded extent of the divine essence, why would it not then be possible to conclude that the extension of God would fulfill two purposes? In the first place, this extension would itself supply the necessary basis for all measurement while secondly, and even more important, from our ability to keep on applying forever yet further measures and our inability to terminate logically the object measured (space or the divine extension) we come to realize in a crude yet valid way both the necessary existence of God's essence and the unlimited character of that essence.[10] But here, as above, this does not involve us in a conception of God as material, for we are reminded that in matter we encounter both the tangible and the impenetrable, while in space ubiquity and infinite repeatability are the major characteristics. It is of great interest to note that More has introduced a terminology quite different from that of Descartes for the description of matter. Matter no longer is to be defined as that which has extension since from the notions we have of matter impenetrability and tangibility are much more suitable as descriptive terms. As for the distance between two bodies this may be regarded as the privation of contact and in so far as the distance is greater or less, just so far will the privation of touching be greater or less. If all bodies are imagined out of the world there will still remain space and distance, the former, since it is characterized by different properties than matter and the latter, since it forms the permanent possibility of the separation of bodies. Distance, though, is not something other than space nor does its meaning depend upon the existence of body. It is but an aspect of space when space is considered as measureable.

Up until this point, as we can readily see, More's attention has wavered between a direct attack on the problem of space with an investigation of its properties and the more appealing task of a development of a Neo-platonic theology. In

[8] *Op. cit.*, p. 218.

[9] Henry More, *A Collection of Several Philosophical Writings, etc.* (London, 1712). Contains, *The Antidote Against Atheism*, 1st ed., published 1653, appendix added 1655, subsequent references are to the appendix as it appears in the 1712 *Collection*, pp. 199–201.

[10] *Op. cit.*, pp. 199–201.

the letters to Descartes the conflict between the congenial Neo-platonic tradition and the new science compelled More to attempt a reconciliation of the claims of matter and the claims of the immaterial. There appears to be latent here a desire to give to spirit real metaphysical validity but a validity that will accept the formulations of science. If extension is to be the test of the reality of matter, why is it not possible to use this same test for the reality of spirit? Descartes, as is well known, had discarded other possible standards for the material, why should not More also discard other tests for the immaterial, centering his attention upon extension? In pursuing such an aim a very important difficulty is at once encountered. If that which defines matter is extension and if spirit has this attribute of extension as well, is not spirit identified with matter? What have we left by which we may distinguish between the two? The challenge to preserve the dualism is not neglected by More. He is not willing that spirit should ever be confused with matter, for is not the metaphysical superiority of the immaterial the end of his philosophy? Nor is he any more willing to recede to a monism denying the existence of matter; pantheism is as abhorrent as materialism. But there is still a means of escape. Give to spirit the attribute of matter, extension, but show at the same time that this by no means exhausts the attributes of spirit. Spirit is to have a plurality of attributes and just so far as the richness in number of the attributes of spirit transcends the paucity of the attributes of matter to that extent will spirit excel in metaphysical importance the importance of the material. But there is still another difference, for in our notion of matter we consider tangibility and impenetrability. There is not only a difference in number but a difference in kind. That such a conclusion seems to involve a sliding scale of reality is not so far as I know pointed out by More but that such a conclusion would do violence either to his instincts or his Neo-platonic heritage, I doubt. The defense of spirit against the rising tide of Continental and English materialism rests on this, spirit is to have all that the materialist deems important for matter but much more, as much more as the spiritualist has always felt the immaterial should have.

But the problem of space cannot as yet be abandoned. The ghost of the Cartesian plenitude has not been laid in England. As we shall see later, the nature of space is receiving attention from the immediate contemporaries and in some measure associates of More at Cambridge. Both Isaac Barrow and Ralph Cudworth deem the problem worthy of attention both for itself and in relation to their more particular interests. With the publication of the *Divine Dialogues* (1668) More turns his efforts with more energy than before to a consideration of space and the proofs of its reality. The treatment opens with two examples,[11] the case of an arrow shot into the air and in its transit describing a curved line, and the imagined rotation of a cylinder in which a line has been drawn from the center of the upper base to the periphery of the lower base so that from the rotation a cone of rotation will be formed by the line connecting the two bases. The question is now raised as to the nature of the medium or the locus in which the curved line and the cone appear. A ready answer solves the problem.[12] The locus of the lines in question is space,

[11] More, *Divine Dialogues*, 2nd ed. (London, 1713), pp. 52–53.

[12] *Op. cit.*, p. 53.

it is space that forms the immovable medium for the motion of matter. Space is distinct from matter yet possesses extension so that space partakes of at least the same reality as the material. Extension and matter are not equivalent terms but distinct entities existing in their own right. At this point the troublesome interlocutor who represents a Cartesian physicist interrupts with the suggestion that the extension provided for these particular cases is but imaginary, and that truly it is only real matter and real extension that can be used interchangeably.[13] To this it is retorted that this extension:

> ". . . is so imaginary that it cannot possibly be dis-imagined by human understanding. Which methinks should be no small earnest that there is more than an imaginary being there."[14]

It is here that More slips over into a remarkably different type of argument from any he has used before or employs later. Space is possessed of such a nature and stands in such a relation to human understanding that the intellect is never able to think away the concept. Not of course that the concept is continually present before the mind but if ever the mind does consider space, space will be of such a character that the mind cannot conceive of space as not existing. But is space intimately connected with or a part of the mind? The contrary is asserted. Space is real, real in the sense that although it may enter into the relation called knowing, this relation is always of such a character that the term which forms the object known is unaffected by the term which does the knowing. And again, so complete is the externality of this relation that the mind in its relation to space is unable even to affect its removal or think of it as not existing. The relation of this conclusion to the second argument of the *Transcendental Aesthetic*[15] is too remarkable to be passed over. In the latter work we discover that our inability to disimagine the existence of space is offered as a valid reason for concluding that space provides one of the forms of pure sensibility and that in this necessity which accompanies our knowledge of space we have the other Kantian criterion of the *a priori* quality of the forms of knowledge. But we must neglect an effort at an interpretation of the *Critique of Pure Reason* and trace the conclusions that More drew from his argument. At no place do we find more clearly stated the relation that More hoped to develop between his theory of space and his concept of the nature of the immaterial or God. At once Bathynous, "the deeply thoughtful or profoundly thinking man"[16] is made to say that of God's essence he has:

> ". . . always been prone to think this subtile extension (which a man cannot dis-imagine but must needs be) to be a more obscure shadow or adumbration, or to be a more general and confused apprehension of the divine amplitude. For this will be necessarily, though all matter were annihilated out of the world. Nay, indeed this is antecedent to all matter for as much as not matter nor any being else can be conceived to be but in this. In this are all things necessarily apprehended to live and move and have their being."[17]

[13] *Op. cit.*, p. 53.
[14] *Op. cit.*, p. 54.
[15] Cf. Kant, *Critique of Pure Reason*, translated by Müller, 2nd ed., p. 19.
[16] *Divine Dialogues*, p. xxxii.

Space is not only real in that it partakes of the same reality as matter while remaining distinct from matter but it is also necessary, and from this necessity is deduced not only its reality but its reality as a faint copy or suggestion of the divine extension of God. This is not, however, developed by More as a direct proof for the existence of God. An examination of space as something real will not show us God as existing; the best that it can afford us is but a manifestation of the real presence of God. God as existing in the world, More would contend, the reality of space serves to make clear, but the large question of whether God does or does not exist beyond the limits of the world the reality of space is not called upon to show. If the treatment is generalized at all it is only from the omnipresence of space, but here again the omnipresence of space is dependent on God and God's existence is in no way limited or exhausted by extension.

By now the argument has about run its course but for an objection expressed by the Cartesian representative in the Assembly. Cuphophron, "a zealous, but airy-minded, platonist, and Cartesian, or mechanist,"[18] is made to say that in so far as he can see, if both God and matter were exterminated from the world still space would remain because of its necessity. However, if God and matter were destroyed nothing would be left; hence there is a contradiction in assuming that space is necessary. There is but one way out of this difficulty, to conclude once and for all that this necessary extension is but imaginary.[19] But it is replied that this but serves to strengthen the case for the reality of the immaterial. If it is possible to think of the essence of God as exterminated this is but a sign that the proper essence for denoting God has not been discovered, for by definition, God is given that essence which cannot escape from necessary existence. We have already discovered in space that which forces itself upon us by necessity. In giving extension to that attribute of God which is His divine amplitude we have but combined similars.[20] In this way a grave danger is avoided; the identification of God and matter, or as generalized, the identification of the immaterial with the material. This is the great mistake of Descartes, that by giving to matter necessary existence, and then making extension the essence of the material, he has confused one of the most necessary of God's attributes, His divine amplitude, with an attribute of matter. Such a God could be imagined as not existing just in so far as matter may be unnecessary, in the sense that it can be destroyed in thought. But once the essence of God is considered in its relation to His necessary attribute of extension, denying at the same time extension as essential to matter, the case is saved both for the nature of God and the reality of the immaterial.

In the *Enchiridion Metaphysicum* (1671) there is little new material. And although this work may easily be said to represent More's most finished account

[17] *Op. cit.*, 55. This passage should be compared with the one quoted from the *Enchiridion*. Here we do not find space identified with God's essence. Only later, in the *Enchiridion*, is the identification at all apparent.
[18] *Divine Dialogues*, p. xxxii.
[19] *Op. cit.*, p. 56.
[20] *Op. cit.*, p. 57.

of the questions we have been dealing with, the treatment is but an expansion, with more detailed examples and more formal presentation, of his older ideas. There is, however, one detail which while not so important in itself serves to throw some further light on the extent to which More tended to identify space with God. The argument is by analogy and we find listed twenty epithets which More contends belong both to pure extension and to God.

> "This infinite and immobile space which is so certainly discerned in the nature of things will seem [as we shall finally note] to be something not merely real but divine. [This will be manifest] after we have enumerated those divine names and titles which precisely harmonize with it; and these titles will create strange confidence that [the reality] to which so many splendid attributes belong cannot be a nothing. [The attributes of which I speak] are these which follow which severally belong to Metaphysical Primal Being. As, Unum, Simplex, Immobile, Aeternum, Completum, Independens, A se existens, Per se subsistens, Incorruptibile, Necessarium, Immensum, Increatum, Incircumscriptum, Incomprehensible, Omnipræsens, Incorporeum, Omnia permeans et complectens, Ens per Essentiam, Ens actu, Purus Actus. There are no fewer than twenty epithets by which the divine Deity is wont to be described which harmonize most exactly with this infinite internal place which we have demonstrated to exist in the nature of things . . ."[21]

In 1684 we have More's last attempt to set forth and defend his position. In a letter to his friend John Norris (1657-1711) the question is raised of the divisibility of space, and the answer given is that space, while subject to logical division, cannot be thought of as physically separated into parts. Space is immaterial and accordingly for More, "Ens unum per se et non per aliud."[22]

As we have seen from the foregoing account of More's theory of space the implications are extremely complex. In the first place, this theory breaks with the Continental tradition as established by Descartes. In this change will be found the beginnings of many assumptions that determine the particular type of theories of space and time which we shall be called upon to examine later. Secondly, More has developed a theory of space which insists that it is absolute. Two things are of particular interest in this connexion, the methods employed and the result itself. In developing the proof of the reality of space as necessary and in the illustrations which fill such a large place in the *Enchiridion Metaphysicum*[23] we may distinguish two approaches to the problem. In the first of these, the way has been laid open for much of the theological discussion that is to follow. Of importance for this is the tendency to find in space either an attribute of God or God's essence.[24] In the second approach, the appeal to the senses, an attitude of mind is clearly indicated which shows the historical plausibility of Newton's experiment with the rotating pail of water. But in the development of a theory of absolute space the effect on later English thought is even greater. Implicit in this belief in absolute space is the other belief that this space is required as an absolute frame of reference for all phe-

[21] Henry More, *Enchiridion Metaphysicum* (London, 1671), ch. 8, sec. 8. From an unpublished translation by Mary Whiton Calkins.

[22] John Norris, *The Theory and Regulation of Love*, 2nd ed. (London, 1694), p. 128.

[23] See especially Ch. 6–8.

[24] Cf. quotations from *Divine Dialogues* and *Enchiridion*.

nomena. In fact, the history of space, as it is to be interpreted for English science, is a continual conflict between the merits of absolute and relative or measured space as the means of explaining the natural world. Indeed, the theories of space as they gradually change from the great emphasis on an absolute in More to the relative in Berkeley may be construed as the repeated application of Occam's razor; as an ever increasing tendency toward the relativistic and nominalistic. The exact use that science was to make of this absolute space we must consider later in an exposition of Newton; it seems sufficient to realize at this time that the theory has been definitely formulated for English thought in contrast to the Continental tradition of Descartes and Leibniz that space is relative and only finds its meaning as considered together with body.

But it is just in this prevalence of the Cartesian notion that the reality of body is determined by extension and in the authority that Descartes gave to this belief that More hoped to justify the reality of the immaterial. Here More represents a combination of changing traditions. On the one side, he accepts and believes in the primacy of spirit, while all the while he admits the reality of the material. On the other hand, there are the stirring developments in physical science initiated by the work of Galileo and many others. The certainty attaching to the results of the new science seemed too great to neglect, and if it should prove possible to employ "modern" scientific theories of space and matter to reinforce arguments for the reality of spirit, so much the better. More accepts the Cartesian extension as an attribute of the material, in the hope that this attribute may also be applied to spirit, thus giving spirit a reality equal to the avowed reality of body. We have traced the way in which this was attempted, and here we find a tradition starting which comes into full importance for English speculations somewhat later.

Remembering then these implications of More's theory of space let us trace their development through the work of Newton, Locke, Berkeley, and the lesser men of this period. In Newton who might best be studied next we find their most fruitful application for physics. Locke and Berkeley provide of course the most detailed account of space and time as these arise in their respective efforts to construct a theory of knowledge.

But before we turn to Newton we must consider the complementary theory of time. In many ways Isaac Barrow, a contemporary of More and the teacher of Newton, completed in analogous fashion the account that More has given of space. Together with Barrow we must also examine some of the work of the other so-called Cambridge Platonists.

CHAPTER III

ISAAC BARROW

As might be expected of a self-denoted follower of Plato, More had but little to say of time; and although his work shows that he was influenced far more by Neo-platonism than by Plato, the same conclusion seems valid. In a few places, notably the appendix to the *Antidote Against Atheism*,[1] More suggests that by time he would have us understand that notion of duration which we are enabled to form from a contemplation of the infinite duration of God's essence. Our notion of time is, like that of space, a necessary one for it is derived from the necessary duration of God. The major characteristic of time is the very fact that we cannot but imagine that there is something that endures without beginning or end. By this conclusion we postulate an essence that has no beginning and no end. Such an essence points most clearly to the ever enduring essence of God. Let us broaden our identification of space with the divine attributes and see in time but another manifestation of God, not only as extension, but as continual and perpetual endurance. Time becomes for More an entity just as real as space and possessing the same type of necessity. As with space, More has attempted to show that for philosophy time is real and that proof of its reality depends largely upon the peculiar relation that time bears to the understanding. This relation as we mentioned before is of such a character that although the mind cannot destroy time, yet time is neither dependent nor contingent upon mental laws. But this notion of time is of no less importance to science than the notion of space. In his treatment of time More has given to physics another absolute. The flow of time is equable and certain and against this background of definitely determined and regular duration is to be placed the manifold of phenomena. For theology the notion is of equal importance with the concept of space as the "divine extension." The "divine extension" now possesses everlasting duration and in this possession, More believes, the immaterial is firmly assured dignified metaphysical existence. Even though you may be a Cartesian, it is possible to imagine More as arguing, I have shown that spirit is just as real as your matter. If matter cannot be destroyed neither can the immaterial for it always endures from its ever enduring attribute which is time itself. If the reality of matter is from extension then spirit is just as real for the attribute of spirit as the extended is space itself. The effort made by More to protect himself against an identification of the terms "matter" and "spirit" have been, I believe, sufficiently explained before.

The question of the nature of time was to receive yet further treatment by another member of the group working at Cambridge. As we have seen, most of More's attention was given to determining the nature of space while time

[1] Henry More, *A Collection of Several Philosophical Writings, etc.* (London, 1712). Contains, *The Antidote Against Atheism*, 1st ed., published 1653, appendix added 1655. See especially pp. 199–201.

is only briefly discussed. In the work of Isaac Barrow (1630–1677) this is far from true. Indeed, in many ways, the situation is reversed and in Barrow's writings we find the attempt to formulate for time a solution largely comparable to the solution More had given for space and merely suggested for time. Let us consider the mathematical and geometrical lectures of Barrow, bearing in mind that Barrow may well be included in that ill-defined group, the Cambridge Platonists, since he is working at Cambridge during the same years as both More and Cudworth. That his teachings also justify his inclusion I shall try to show later.

Before turning definitely to Barrow's theory of time it is probably best to consider first his conclusions on space, since these serve to connect Barrow to some extent with More. Moreover, Barrow's opinions on space provide a definite point of departure for his consideration of time. The *Lectiones Mathematicae* and the *Lectiones Geometricae* were delivered at Cambridge in the years 1664–1666. The *Lectiones Mathematicae*, as published, preceded those on geometry and it is to these[2] that we direct our first examination. Space is to be distinguished from magnitude,[3] and by this distinction Barrow means three things. When we speak of space we refer to something that the name applies to, a definite conception within our minds, and further to an existing entity which in some way this conception copies or represents but which is not magnitude.[4] Furthermore, the connexion between space and quantity is a very intimate one. Space neither exists apart from quantity nor is essentially different from the quantitative; in fact, space has no dimensions proper to itself, for whatever dimensions space may seem to have these dimensions apply just as well to magnitude.[5] What then may we call space? Space is the possibility of magnitude. That is to say we are to imagine that before the creation of the world there was no body, but that in order for body to be created it was necessary to have ready the space to receive it. The possibility that the creation of body meant the simultaneous creation of space as the necessary ground for the reception of body is temporally but not logically possible. Since there can be no body without space to receive it, Barrow would insist, space can only be conceived as logically prior to body. It is in this sense that space is distinct from body although it receives its determinations or magnitudes, e.g., its dimensions, from that which has quantity.[6] There will follow from this two apparently contradictory attributes of the spatial. It is both determinate and indeterminate. For example, as determinate that portion of space inclosed within some figure of geometry will obey the laws of geometry dictating the properties of the particular figure in question. But it is also indeterminate, for it is possible to construct within space such figures as we choose. Space then represents, as ground, the indefinite or unlimited possibility of the construction of magnitudes, yet once a given magnitude exists then space as related to this particular magnitude is

[2] *Lectiones Mathematicae*, translated by John Kirby as *Mathematical Lectures* (London, 1734).
[3] *Op. cit.*, p. 175.
[4] *Op. cit.*, p. 175.
[5] *Op. cit.*, p. 175.
[6] *Op. cit.*, p. 176.

determined by the properties of the magnitude previously formed.[7] Space is real, real in its relation to God as the logical possibility of the creation of an universe, and from this intimate connexion with God as instrument there is again suggested the attitude of Henry More regarding space as a divine attribute. But space is also real for geometry, for it supplies to geometry the ground of geometrical construction and to this extent geometry becomes the science of spatial magnitudes. Through geometry we are enabled to explore the unlimited possibilities of spatial forms, limitation existing only after a given form has come into existence.

Although a careful effort has been made to define the distinction between space and quantity, the customary English divergence from Descartes, this is not insisted on in the treatment of time. In the *Lectiones Geometricae*[8] the problem of time is raised and we are told first, that, "time (to speak abstractly) is the continuance of anything in its own Being."[9] It is obvious at once that some things last longer than others, consequently, time may best be defined quantitatively, for it is possessed of such characteristics as equality, inequality, and proportion and in the possession of these, time may be regarded as a measure of the existence of things.[10] But again the question arises, as formerly in the case of space, does time exist before the creation of matter in the universe?[11] Does not time exist both in and for the empty space preceding creation; that space which is one of the attributes of God, not only the space before creation but also empty space, space beyond the limits of the world? It is answered immediately and unequivocally that time did so exist because time provides the possibility of existence in that existence has duration.[12] Just as space logically antedates body as the place for body, so time antedates existence as the possibility of existence. Again time might have been created together with body and space but unless there was time in which the existence of body could have duration, body could not be; for body that does not endure is not body. Time as well as space is logically prior to body and forms the necessary ground for the existence of body. The possibility that time might be logically prior to space and that space endures and thus requires a real duration for its existence is not suggested by Barrow. The question of logical priority is raised only in connexion with matter. However, since Barrow holds that time enjoys with space this priority and has already found this space real, as an attribute of God, it is not surprising that for him time also is one of God's attributes, His eternal duration. This is not to say that the existence of God is measured by time, but rather that the eternal divine duration is the absolute duration that together with absolute extension forms a ground both for the realm of physical phenomena and the constructions of geometry and arithmetic. Absolute space and absolute time are the attributes of God and through this relation to God find their essential reality. That in turn mathematics and physics find their place and continued existence in this space and time considered as

[7] *Op. cit.*, pp. 176–177.
[8] *Lectiones Geometricae*, translated by Edmund Stone as *Geometrical Lectures* (London, 1735).
[9] *Op. cit.*, p. 4.
[10] *Op. cit.*, p. 5.
[11] *Op. cit.*, p. 5.
[12] *Op. cit.*, p. 6.

God's attributes but made the scheme of things that much the more satisfactory for Barrow. In this respect, if in no other, there is apparent not only the interests of his colleague More but also the protest of the Cambridge group against what they felt was the materialism of the Cartesian physics and the philosophy of Hobbes. Again the attempt has been made to spiritualize the new science by showing that its space and time represent God's attributes.

After this it is not surprising to find Barrow denying that time is motion. Such a reduction would overturn the previous conclusions and offend his theological instincts. Nevertheless, motion plays an important part since through motion we may attain a notion and measure of time. Time in itself, "depends not on either of them; [motion or rest] for whether things move on, or stand still; whether we sleep or wake, time flows perpetually with an equal tenor."[13] Time is a definite quantity to be discovered by motion, for through motion we may compare and contrast varying portions of time. And even more than this, for if motion[14] should cease we could have no knowledge of time. Time is discovered by motion and it is only through motion that we can make this discovery, but time is in no sense dependent for its existence on motion. The only relation subsisting between the two is that motion is the means whereby we can discover variations in the duration of the existence of objects. From this it follows that in simple geometrical lines we may discover an analogy for time since this concept:

> ". . . is a quantum uniformly extended, all whose parts correspond, either proportionally to the respective parts of an equal motion or to the parts of space moved through with an equal motion; it may therefore be very aptly represented to our minds by any magnitude alike in all its parts; and especially by the most simple ones such as a straight or circular line, between which and time there happens to be much likeness and analogy. For as time consists of parts altogether similar, it is reasonable to consider it as a quantity endowed with one dimension only; for we imagine it to be made up, as it were, either of the simple addition of rising moments or of the continual flux of one moment and for that reason ascribe only length to it and determine its quantity by the length of the line passed over. As a line, I say, is looked upon to be the trace of a point moving forward being in some sort divisible by a point, and may be divided by motion one way, viz.: as to length; so time may be conceived as the trace of a point continually flowing, having some kind of divisibility from an instant, and from a successive flux, in as much as it can be divided somehow or other and like as the quantity of a line consists of but one length following the motion; so the quantity of time pursues but one succession stretched out as it were in length, which the length of the space moved over shows and determines."[15]

If now, we consider the above conclusions as they may be relevant to science, it is of first importance to note that space and time are to be regarded as absolutes, in the sense that they act as a ground for all phenomena but are in no way determined by the phenomena that take place in them. Although space may be described by geometry, geometry in so far as it is spatial is nothing but a means whereby the properties of space are related to us. The possibility

[13] *Op. cit.*, p. 6.
[14] *Op. cit.*, p. 7.
[15] *Op. cit.*, pp. 13–14.

of all body, just as the possibility of any geometry, depends upon space, although body and geometry are distinctly separate from space. In a large measure the same is true of time. If geometry is a description of space then motion enables us to realize the nature of time, but time and motion are not the same. But there is another difference, for the requirements of motion involve time but incompletely. The nature of time points to an even more fundamental quality in the "go of things." Time states the existence of bodies; it is a measure of how long existence may or may not belong to body. Motion, however, is contingent upon the existence of body as well as upon the existence of time. Motion is dependent upon time in so far as body, the necessary existent for motion, depends upon time the necessary determiner of the existence of body. As we mentioned above, Barrow does not make explicit the logical priority of time to space. He is content to place them on terms of equal logical efficacy and justifies this common treatment by regarding them as manifestations of God's attributes. It is in this reiteration of the divine reference of space and time that the theological implications occur.

Although Barrow may well be regarded as further developing More's tendencies in this direction the later work has importance of its own. Space and time appear to be related to God as instruments through which He created the universe. The question of the creation of these instruments is not raised since they are included in the aspects of God's nature. God's omnipresence provided the place in which all phenomena are to be manipulated while God's eternity affords that duration which gives to phenomena their beginning and end. The world that science and mathematics treats has its being in space and in time and these in turn are constituted by the divine extension and the divine duration. Theology includes within its realm of discourse the very space and time of physics and mathematics.

In these respects Barrow has continued for philosophy and theology the tradition of More. The reality of space and time are never questioned; to do so would be impious. If space and time bear the relation to God which has already been insisted upon they do in so far forth enjoy a reality even greater than that of Cartesian matter. At their best they are attributes of God, and in their weakest formulation there seems reason to hold that Barrow might be thought to consider them ideas or eternal forms in God's mind. But for an entity to be an idea in the mind of God would not mean anything "subjective"; God's act of "knowledge" would be *sui generis* and in no sense comparable except by metaphor to knowledge as constituted in a finite or human intellect.

As method Barrow's investigations present an interesting contrast to his predecessor. Throughout, the insistence has been upon the quantitative aspects of time and space. By quantitative measures we are able to obtain our knowledge and such knowledge is superior to any other. Our knowledge of the nature of time, for example its equable flow, is acquired by picking out that motion which is most regular. In addition to the choice of regular motion we must apply ever refined corrections. There is a suggestion that through an increasingly accurate procedure, either of mathematics or science, our measures may reveal to us the nature of that which is measured. In this there seems to be implicit the concept of limit; absolute space and time are the limits approached

as we perfect our technique. But this seems to be as far as Barrow went and possibly further than he intended for the reduction of God's attributes to mathematical limits would have done untold damage to his further theological wishes. The strength of these wishes can best be realized when we remember that Barrow still postulates absolute time even though we could never be aware of it.

Of the remaining Cambridge Platonists very little need be said. With two exceptions, Cudworth and Smith, the members of the school found no direct interest in the problems of space and time in so far as their writings reveal. Their efforts are devoted toward more purely theological questions and in the conflicts growing out of the Commonwealth and, later, the Restoration. For Ralph Cudworth (1617–1688) the problem of space is brought to no definite conclusion. His major effort, the *True Intellectual System of the Universe*[16] leaves the question of the reality or unreality of space an open one. He feels that space is only potentially infinite, i.e., God has it within his power to ever increase the limits of the universe. And since the limits of space can ever be increased this will mean for Cudworth that it cannot be actually infinite for an actual infinite would allow of no increase.[17] A similar method of reasoning is applied to time with this difference; time had a definite beginning, for an infinity of time past is impossible, as each moment of past time must have been at some moment present. The confusion that Cudworth here introduces through an equivocal usage of the term infinity is sufficiently apparent without comment.[18] He intends to draw two important conclusions from space and time. They are neither attributes of God for they are limited, nor are they a basis for concluding, as he feels Descartes had done, the self-sufficiency and necessary existence of matter. In other words, space and time may be what we choose to make them with the reservations that in their nature we do not find God nor from their qualities deduce a matter which would exclude God and lead to atheism.

From John Smith (1618–1652) we are to conclude that there is nothing in God's nature that gives us knowledge of time or space because by God as eternal and omnipresent we mean that God does not lack either duration or extension. Our idea of time is derived from both the succession of our own thoughts and the succession of objects. Lacking these there is no concept of time. Although the world itself may act as a great clock due to its continual internal changes it can know neither past time nor join together the past, present, and future. Such a "chronological synopsis" is possible to the infinite mind of God just because this mind undergoes no change. As for God's extension this is to be interpreted with Plotinus as God's unlimited power to act everywhere, not as More suggested, the unlimited real space underlying and filling all things.[19]

The progress made in the work subsequent yet parallel to More consists largely in two things. In the first place, Barrow in working in the direction set by More provides for time an account similar to More's account of space. Also in

[16] 1st ed. London, 1678.

[17] Ralph Cudworth, *The True Intellectual System of the Universe* (London, 1743), 2 vols. paged continuously, pp. 643–644.

[18] *Op. cit.*, p. 644.

[19] John Smith, *A Discourse Concerning the Existence and Nature of God.* Reprinted by E. T. Campagnac in *The Cambridge Platonists* (Oxford, 1901), see especially pp. 167–169.

the quantitative method developed by Barrow we have a further refinement on the "geometrical experiments" of More. In the second place, there is discernible in the speculations of Cudworth and Smith a dissent from the interpretations of their contemporaries. Smith objects to the new formulations and reinsists on a more mystical approach in so far as God is concerned. Cudworth, on the other hand, feels that in this identification of space and time and divine attributes are the seeds of atheism. The problem as related to theology shows signs of dissension. It is still some time before this is developed with the characteristic intenseness of theological disagreement. It is necessary to wait until science from its point of view has further investigated the problem. On the work of science philosophy also waits, so that it is not until the results of the *Principia* are apparent that philosophy and theology consider again the various possibilities. Consequently, it is necessary, both logically and historically, to consider next the work of Newton, particularly those treatments of space and time which may be found in the *Principia Mathematica* and in the *Optics*. It is only after this examination that we can clearly realize the important and definite relation that subsists between Newton and the Cambridge Platonists.

CHAPTER IV

ISAAC NEWTON

So far we have seen certain definite changes in the reactions of English thinkers to the Cartesian theories of space and time. In the work of Descartes there was present the most concerted effort to identify space with matter, thus in one more way making matter the center of interest for science. In matter and from the reactions and changes of matter it was hoped that a means of explanation could be secured for the phenomenal and more particularly for space. English opinion was not favorable to an acceptance of these conclusions. More, with the definite purpose of asserting the primacy of spirit, disagrees with Descartes and establishes his own theory of space. Barrow enters his protest against the claims of materialism and places himself with More in the assertion of the extendedness of spirit. In this attempt Barrow develops a theory of time which completes in certain respects the work of his associates. Thus the immediate point of departure for theories of space and time in England is most readily provided by these two men. Their speculations are the most recent as well as the most complete in their implications for science, philosophy, and theology.

In these facts we find our first reason for believing that Isaac Newton (1642–1727) was profoundly influenced by them in his own theories of space and time. In the second place, More, Barrow, and Newton were contemporaries at Cambridge, and it does not seem improbable to assume, when we remember that Barrow was Newton's tutor, that Newton was thoroughly familiar with the work not only of Barrow but of More. Thirdly, we shall see that Newton in his attitude toward absolute space and absolute time is much akin to Barrow in that he also appears to conclude that these absolutes, while they may not be classed with observed phenomena, nevertheless are real and existent. Furthermore, both neglect to show the usefulness, if any, of these absolutes for the explanation of physical occurrences. Fourthly, the current theological interest attached by More to space is neither neglected by Newton nor are the conclusions greatly different in the work of the physicist and the writings of the Cambridge Platonist. And lastly, it should be mentioned, although the conclusion is necessarily somewhat vague, that Newton in his construction of the *Principia* is essentially foreign to the work of the Cartesian physics. If in this physics the method employed is largely geometrical and the subject matter consequently matter as extended then the formulations of the *Principia* present a remarkable contrast. First, it should be noticed that there is an apparent return to Galileo for the essential attributes of matter. Matter is not to be classified as the extended but as that which has mass. The quantity of stuff in a body is to be the irreducible character of body and extension is placed to one side as a necessarily accompanying but less fundamental attribute. Secondly, the approach to mathe-

matics is from arithmetic and algebra, not from geometry. In regard to this last it is not only possible to see Newton's reactions to geometry in his algebraic notations to Euclid's proofs but also it should be remembered that in the invention of the calculus Newton provided himself with a most effective instrument for the atomic treatment of phenomena especially when it is postulated that the "atom" is mass in motion. Newton breaks from his immediate continental predecessor both in the method of investigation, in so far as this is a new kind of mathematics developed out of the arithmetical interests of Barrow, as well as in the emphasis placed upon matter as mass in notion in contrast to static extension of the Cartesian physics. Newton as a mathematician and physicist belongs intimately in the tradition being formed by Englishmen of his day. Once again there occurs the English protest to Descartes and his followers. Consequently, bearing in mind the work of Barrow and More as they more particularly treat of space and time let us examine Newton's own theories as they relate not only to his cosmological but to his philosophical and theological predilections. It will then be necessary to turn to the more closely allied Newtonian physicists in England to complete, to some extent, the relation between seventeenth century physics as worked out in England and the corresponding conclusions on space and time. Only then, it is believed, will it be possible to treat properly of Locke and Berkeley.

The *Principia*[1] was first published in 1687 and the first portion of the first book is largely devoted to various definitions, e.g., those of space and time.[2] The account opens with a distinction which Newton believes necessary since common opinion seems to form its idea of space and time from the presumed relation that these entities have to "sensible objects." The first classification divides space and time into "absolute and relative, true and apparent, mathematical and common."[3] Probably the best approach to a meaning of these terms is through an examination of the description that Newton gives. Let us consider "absolute, true, or mathematical" space as contrasted with "relative, apparent, or common" space. In the first place, absolute space has the characteristics that in all its "parts" it is rigidly and exactly similar while at the same time these "parts" are immovable. Absolute space possesses these qualities without external reference for by its nature it is completely self-contained.[4] Place, however, is to be distinguished from space in that place always has reference to body while space can only be related to itself. Place as well as space may be divided into absolute or relative depending of course on the kind of space in which a body is situated. But there are two more distinctions to be drawn. Space is neither the position of body, that is to say, the situation or the place of a body, nor the surface of the body. To support these conclusions Newton draws our attention to the great differences in the surfaces of bodies which would exclude the identification of the exterior of bodies with space since space is simple and one throughout. Nor is it possible to call space position since position is that which

[1] All references to the *Principia* are taken from the translation by Andrew Motte, *The Mathematical Principles of Natural Philosophy* (London, 1729), 2 vols., by volume and pages.
[2] *Op. cit.*, I. 9–18.
[3] *Op. cit.*, I. 9.
[4] *Op. cit.*, I. 9–10.

has no quantity, indeed it is not even place for we regard positions as a property of places, the attributes which locates a place as here or there. Place, to conclude, is something internal to body and serves to state how much of space is filled.[5]

In contrast to this absolute, immutable, and simple container for all bodies we have relative space. Relative space, like absolute space, is to be distinguished from body, position, and place, but further it is to be distinguished from absolute space since relative space is only a measure of the absolute and is determined by reference to bodies in the sense that bodies provide the boundaries or limits for the relative.[6] Through a consideration of motion the distinction becomes more clear. Motion like space enjoys division into absolute and relative and we are to regard that motion as absolute which occurs with reference to absolute space. Such an absolute motion would be the transference of body from one "part" of absolute space to another. In such motion there would be no reference or relation to any other body, the only reference would be to space itself.[7] However, there is another and larger class of motions, i.e., those motions a knowledge of which is possible through the comparison of the motion of one body with the motion of another body. Motion of this kind, the observation of which has its origin in the relation of two or more bodies, is to be referred to relative and not absolute space. Relative space is to be discovered and its properties revealed through an examination of motion. If a motion is relative then the space to which this motion refers is relative also. If, however, the motion is absolute the space to which this motion relates is absolute. By these distinctions Newton arrives at an important conclusion. Absolute space is not something immediately experienceable. It can only be derived by an observation of motion. The problem changes from an effort to discover directly the nature and character of absolute space to a very different problem. This second problem requires an analysis of motion and a particular analysis to see if it is possible to distinguish absolute from relative motions. If we can do this we can then infer absolute space as the place for such motions.[8]

Turning to the question of motion we must base our investigation on the forces causing motion for it is only through an examination of these forces that we can decide on the nature of the motion. i.e., whether or not any particular motion is absolute or relative. In our investigation we have a principle that can guide us, for an absolute motion will require a force that acts directly on some absolute mass. If we can discover some force which acts directly on an absolute mass either positively or negatively we can postulate that this acceleration is absolute. This Newton believes to be true since in the case of relative motion, that is bodies moving relatively to each other, an acceleration may result not from a force acting on any particular one of the two or more bodies related but from a force or forces which may or may not act on some or all of the bodies in question. With this problem in mind, and with this principle to direct him, Newton gives an experiment designed to show absolute motion.

[5] *Op. cit.*, I. 10.
[6] *Op. cit.*, I. 9.
[7] *Op. cit.*, I. 10.
[8] *Op. cit.*, I. 11.

"If a vessel, hung by a long cord, is so turned about that the cord is strongly twisted, then filled with water, and held at rest together with the water; after by the sudden action of another force, it is whirled about the contrary way, and while the cord is untwisting itself, the vessel continues for some time in this motion; the surface of the water will at first be plane, as before the vessel began to move, but the vessel, by gradually communicating its motion to the water, will make it begin sensibly to revolve and recede by little and little from the middle, and ascend to the sides of the vessel, forming itself into a concave figure (as I have experienced), and the swifter the motion becomes, the higher will the water rise, till at last, performing its revolutions in the same time with the vessel, it becomes relatively at rest in it. This ascent of the water shows its endeavor to recede from the axis of motion, and the true and absolute circular motion of the water, which is here directly contrary to the relative, discovers itself, and may be measured by this endeavor. At first, when the relative motion of the water in the vessel was greatest, it produced no endeavor to recede from the axis, the water showed no tendency to the circumference, nor any ascent towards the sides of the vessel, but remained of a plane surface, and therefore its true circular motion had not yet begun. But afterwards, when the relative motion of the water had decreased, the ascent thereof toward the sides of the vessel proved its endeavor to recede from the axis; and this endeavor showed the real circular motion of the water perpetually increasing, till it had acquired its greatest quantity, when the water rested relatively in the vessel. And therefore this endeavor does not depend upon any translation of the water in respect of the ambient bodies, nor can true circular motion be defined by such translation."[9]

Here for Newton is an example of absolute motion expressed in the concavity of the water. The experiment falls naturally into three parts. First there is the period of greatest relative motion between pail and water at the time when the pail starts revolving. This is followed by diminishing relative motion and increasing concavity of the surface of the water until this concavity reaches a maximum and the relative motion at the same time a minimum or zero. It is at this point that the second stage is reached, a stage that Newton maintains represents an absolute motion of the water. After this follows the third and last period in which the concavity of the water decreases and relative motion between pail and water increases, the relation between pail and water being the reverse of the relation in the first period. Before stopping to consider the validity of this experiment as a proof of absolute motion and the existence of absolute space let us complete our account of Newton's work with some exposition of his doctrine of time both absolute and relative.

Concerning absolute time we are told that it always, "from its own nature flows equally without regard to anything external."[10] In this respect the definition is very similar to the one for absolute space for both are held to be unique, simple entities existing in their own right and possessing attributes that cannot be affected by events having their locus within them. In contrast to this unperturbed flow we have relative time or the measure of absolute time whereby absolute time is made intelligible. Relative time becomes, through the use of motion, a measure of absolute time.[11] How are they to be distinguished? They

[9] *Op. cit.*, I. 15–16.
[10] *Op. cit.*, I. 9.
[11] *Op. cit.*, I. 11.

are distinguished through the use of an equation for the correction of relative time, this equation affording an ever closer approximation to absolute time which is "true" and "standard." It may be quite possible, Newton suggests, that there is not to be discovered any motion sufficiently accurate to reveal the true immutable flux of duration.[12] Even if this is so and absolute time is only a limit to be approximated we must not consider that the duration of things is not constituted by absolute time. The order of its parts is changeless and only in this immutable order can be placed the real duration of objects. The span of existence given things is not affected by relative time for this is derived from an observation of motion. True time is underived, it is logically prior to all motion, and it is only because it serves as the possibility for the duration of motion that motion is capable of revealing to some extent the eternal and perfect flow.

In the Newtonian account of space and time the effort has been made to point out and characterize six different entities. On the one hand, there is absolute space, absolute time, and absolute motion. Contrasted with these, we find relative space, relative time, and relative motion. Subsisting between all of these entities are relations the immediate purpose of which is to define and limit the classes related while in a more immediate way the relations serve as a means for attaining knowledge of the various classes. In addition to these entities and their relations there is another group, e.g., place and position. The importance of these is quite fundamental to an understanding of Newton's meaning for taken as absolute they refer to the absolute position of absolute mass. The location of mass is obviously of supreme importance in Newton's physics and it seems clear that this portion of the *Principia* is directed toward unraveling this very problem. The assumption of course is made that these masses are located in space and in time, this space and time being something other than the location or the thing located.

If we begin with absolute space we discover that it is an entity to be distinguished from all else, existing in its own right, not to be apprehended by the senses but only to be inferred from various motions. Related to absolute space is the measure of absolute space, or relative space; relative space is not different in kind from absolute space for it is still absolute space only now it is bounded and limited by body. Because of this limitation there follows an important distinction immediately relevant to the question of how space is known. The answer to this question rests upon the assumption that measures are intelligible for intellect. Relative space can be perceived since by relative space is meant a measure of absolute space. Absolute space in itself cannot be directly perceived, but with the measures of this space everyone is familiar. Here in brief appear most of the problems that Locke and Berkeley will undertake to answer. If we shift the terminology we have in absolute space and absolute mass the systems of causes which give rise to our ideas. The correspondence between Locke's usage of "ideas" in so far as these are ideas of primary qualities, and the Newtonian concept of measurement or, where space and time are concerned, relative space and relative time, is very close. Just how close this resemblance is will be more clear when we consider Locke. Even though

[12] *Op. cit.*, I. 12.

Newton's problem of perception is left at this inconclusive stage we may get some further help in understanding the relations subsisting between absolutes and relatives through his account of motion. For this purpose the famous "pail experiment" is of the greatest interest and to an account of this we must now return as Newton's proof for the existence of absolute motion.

In brief the purpose of this experiment is to observe absolute acceleration. If Newton can show that such an observation is possible we may then assume that he has some basis for his conclusion as to the existence of absolute motion, force, and space. Is there anything in the acceleration of the water which would lead us to a belief in absolute acceleration or is the acceleration of the water of such a kind that it might just as well be explained if only relative acceleration is assumed? The crux of the difficulty is the relation between the acceleration of this water and the forces implied by that acceleration since by the first law of motion[13] an acceleration implies the existence of a force. Now obviously the water in question is accelerated since the velocity of the water varies from zero to a maximum and back to zero in relation to the earth while the velocity varies from a maximum to zero and back to a maximum in relation to the pail. Is this acceleration the result of some force applied directly to the water or could this acceleration be an apparent acceleration from the relative acceleration of two bodies? Before directly answering this question let us note another factor in the experiment. As a result of the acceleration of the water the surface of the water changes from a flat to a concave plane. Furthermore, the degree of concavity of the surface of the water is directly proportional to the acceleration of the water with respect to the earth and inversely proportional to the acceleration of the water in respect to the pail. Now in the change of the surface of the water from flatness to concavity force is implied by the definition of force[14] since those particles which constitute the mass of the water have changed position in such a way that the form of the mass of water has changed, i.e., when the particles were in position A. the surface of the water was a flat plane, but later when the particles were in position B. the surface of the water was a curved or concave plane. The existence of forces is implied both by the acceleration of the water and by the changing surface of the water. However, the first law of motion depends on the definition of force and the definition of force is implied in the first law of motion. This is clear since motion is our evidence of force and force is to be detected by motion. On the one hand, we have gotten no further than the truism that the acceleration of the water implies motion, a proposition implicit in the definition of acceleration. In this case the truism is not very helpful for we are attempting to discover whether or not the acceleration and motion is absolute.

On the other hand, we have discovered that a change in the surface of the water implied motion and from the equivalence of the first law of motion and the definition of force must also imply force. Consequently, that motion of the particles of the water which results in the concavity of the surface of

[13] "Every body perseveres in its state of rest, or of uniform motion in a right line, unless it is compelled to change that state by forces impressed thereon." *Op. cit.*, I. 19.

[14] "An impressed force is an action exerted upon a body in order to change its state, either of rest, or of moving uniformly forward in a right line." *Op. cit.*, I. 3.

the water implies the action of force directly upon the particles of water. From this we can only conclude that the motion of the water, as motion, does not serve to show whether or not that motion is absolute since considered merely as motion it is relative both to the earth and the pail, the two relations being reciprocal. However, when we consider that as a result of the motion of the water the water changes form the demonstration acquires new significance. This change of form is of such a kind that it is possible to think of it as arising even though the water had no relations to anything else. If this can be conceived it seems possible to postulate that when the water was at rest, absolutely by the requirements of the hypothesis, its surface would be a flat plane. Now, if this water should acquire motion, motion that is absolute by the same requirements of the hypothesis, it is conceivable that its surface would become concave, the degree of concavity being directly proportional to the absolute motion. If we leave this purely hypothetical case and return to the demonstration it seems valid to conclude that in the demonstration, even though relative motions are present, these relative motions do not explain the condition of the water, its concavity. But by the definition of force and the first law of motion, we are able to explain concavity. However, more is implied in the experiment and the theorems that explain it than we have as yet considered.

In Newton's formulation of the definition of force and the equivalent first law of motion there is implied the existence of absolute rest and motion and consequently absolute space and time. The "rest" from which a body is moved and the "uniform motion" subsequent to this rest are quite clearly absolute rest and absolute motion. To the question why Newton ever postulated absolute rest and motion it must be answered that they are required by his first great assumption of absolute masses as the basis for all phenomena and as the constituent objects of the world of science. This world of science is a system of absolute particles which can never suffer change in themselves but only enter into various systems of external relationships. The problem requires a solution which can admit change while at the same time the elements participating in the change undergo no variation in essence. The answer given by Newton, in the law of motion, seems to be the necessary one if we grant the validity of absolute mass. Mass can only be absolute, in the sense defined, if motion, rest, space, and time are absolutes.

When we regard the demonstration of the revolving pail against this background, the very system of Newton's assumptions, it seems clear, by the first law of motion and the definition of force, that absolute motion has been assumed, and in this way the concavity of the water is an example of absolute motion and force. However, if other postulates had been assumed by Newton there is little doubt that the experiment could be explained in "other ways," e.g., from relative motions alone. Once Newton's law of motion is accepted the demonstration is valid by that law of motion although this does not exclude the possibility that the demonstration could be explained differently by some other law of motion. In brief, the revolving pail of water "proves" absolute motion if the truth of the first law of motion is granted but it can also "not prove" absolute motion if the first law of motion is denied. Thus we may say that if the first law of motion is true the demonstration proves absolute motion. If the

first law of motion is denied the demonstration is neither valid nor invalid since its meaning will always depend upon some general principle. In this sense the experiment is a demonstration of absolute motion, a demonstration which is valid within the Newtonian system but not necessarily valid as a proof of absolute motion within any other system.

At this point it seems well to anticipate the treatment of Berkeley with a short account of his criticism of this experiment. The reasons for doing this here are that this criticism does not form an integral place in Berkeley's system, i.e., it is not a criticism of absolute motion according to Berkeley's epistemological relativism. Also Berkeley's remarks are more relevant to what we have just been saying than they are to his own treatment of motion. In the *Essay Concerning Motion*[15] Berkeley takes exception to Newton's demonstration by analyzing the circular motion of the water into two components. The first of these is from the axis of rotation while the second is at right angles to the first and is the tangent. When the water rises we are to understand that the tangential component exceeds the axial component. Therefore, Berkeley concludes, we do not have an example of absolute circular motion.[16] However, even if we allow the pertinency of the analysis of circular motion the objection appears to miss the point since the argument is not in defense of circular motion but of concavity as the effect of absolute forces and in consequence absolute motion.

In the second place, Berkeley maintains that the motion of the water in the vessel is:

> ". . . compounded of the motions, not only of the sling or bucket, but of the diurnal motion of the earth round its axis, its monthly motion round the common center of gravity of the earth and moon, and its annual round the sun; on account of which the . . . water describes a line very widely differing from a circular one."[17]

Again it should be recalled that when the water is at rest with respect to the earth and in motion with respect to the sun its surface is a flat plane and that the system of motions mentioned by Berkeley are not relevant to Newton's account since concavity of the surface of the water takes place when there is relative motion with respect to both earth and sun. The concavity of the water is to be explained not from relative but from the absolute motions accounted for in the first law of motion and in the definition of force. When Berkeley postulates the fixed stars[18] as marking out the limits of relative space he has introduced a system of reference to which the details of the experiment have no connexion. For Berkeley's other criticisms of absolute space, time, and motion it seems best to wait until we have examined Berkeley's particular theory of knowledge since it is to this epistemology that the treatment owes its meaning.

Of time there is but little to add since the treatment follows closely that of space. Again the evidence for absolute time is involved in the assumption and treatment of absolute mass and the definition and analysis of absolute motion.

[15] References are by section to the translation of *De Motu* in Vol. 2 of the Bohn Library edition of Berkeley's *Works*, edited by Sampson (London, 1898).

[16] *Op. cit.*, sec. 60.

[17] *Op. cit.*, sec. 62.

[18] *Op. cit.*, sec. 64.

Aside from the questions of consistency within his physics it is quite possible to suggest yet another reason for the prominence of absolute space and time in Newton's cosmology. It is from this aspect of the *Principia* as a cosmology instead of merely a mathematical account of motion and moving bodies that a point of contact may be discovered between Newton and More and Barrow. In these two men we found that space and time were given theological implications and that between them and Newton there is at least an historical intimacy. Let us turn now to his writings to see what further basis of comparison may be found between Newton and the Cambridge Platonists and if for this comparison any material is provided to answer our questions.

In an addition to the third edition of the *Principia* it is stated that God:

> ". . . is eternal and infinite, omnipotent and omniscient, that is, His duration reaches from eternity to eternity, His presence from infinity to infinity; He governs all things, and knows all things that are or can be done. He is not eternity or infinity, but eternal and infinite; He is not duration or space, but He endures and is present. He endures forever, and is everywhere present; and by existing always and everywhere He constitutes duration and space. Since every particle of space is *always*, and every indivisible moment of duration is *everywhere*, certainly the Maker and Lord of all things can not be *never* and *nowhere*. . . . God is the same God, always and everywhere. He is omnipresent not *virtually* only, but also substantially; . . ."[19]

And in the third edition of the *Optics* we find added:

> ". . . that there is a being incorporeal, living, intelligent, omnipresent, who in infinite space, as it were in His sensory, sees the things themselves intimately . . . who being in all places, is more able by His will to move the bodies within His boundless sensorium, and thereby to form and reform the parts of the universe . . ."[20]

The above passages have been quoted, with what is maybe tiresome length, because they seem of interest not only for the ideas expressed but to some extent for the form of exposition. There is great hesitation on the question of how far God, space, and time are similar and in what respects they are related. Throughout there is a marked effort to escape a charge of pantheism but at the same time it is very clear that the influence of More and Barrow are in the background. Although absolute space and time may not find a place in the procedures of physics, nevertheless, it is appropriate to treat of them in that connexion since relative space and time are so necessary for the organization of phenomena. In so doing the relative concepts may be felt to acquire greater validity if there is lying back of them a reality of which they are the measure. At the same time, it had already been pointed out how important space and time could be in theology. Now it is well known that Newton's interests in theology, if not in religion, were by no means slight. It is not surprising then to find Newton occupying himself with what were current and immediate theological concepts. Indeed, it is quite possible to believe that with the opinion that space and time were attributes of God Newton might be better enabled to under-

[19] *Op. cit.*, II. 389–390.

[20] Isaac Newton, *Optics, etc.*, 3rd ed. (London, 1721), pp. 345 and 379.

stand what was to be meant by God than if other concepts had been introduced or emphasized. In the first place, it may be suggested that absolute space and time find a place in the *Principia* because as attributes of God they rendered to the *Principia* a completeness, as a cosmology, which it might otherwise have lacked. Furthermore, in this particular kind of treatment the way was open to give to the foundations of mechanical and mathematical explanation a theological justification which does not appear to conflict with Newton's character. In the second place, the postulations of absolute time and absolute space suggests the construction of mathematical entities which might be approached as limits of perfection in the description of physical facts. Just as relative time always more nearly approaches absolute time as we refine our measurements and relative motion approximates absolute motion as we examine forces more carefully, so the scheme of things as a whole may be more clearly understood and discovered as we progress in more detailed experiment and analysis. From this interpretation the use of absolutes by Newton might be understood as an ideal of perfection, an ideal surely existent and for him attainable in matters of space but only as yet to be approximated in questions of time. In the third place, absolute space and time have never failed to make an emotional appeal. Their presence seems somehow to add clarity and definiteness to a world picture. They seem a guarantee of certainty, tidiness, and rigor. Such a world is not open to the claims of scepticism or freethinking, it is final and clear, an unanswerable summation. Such are some of the further implications derivable from Newton's usage of absolute space and time. Of greatest importance certainly for an understanding of Newton is the derivation of these absolutes as necessary consequences from absolute mass. But in addition to this Newton occupies a position in the history of thought, and from this aspect his relation to the tradition of English Platonism represents but a further step in the unfolding of English space and time speculation, this time a step that combines certain concepts of importance for theology with the most satisfactory physics that as yet had been devised. Also, as we have seen, there is implicit in the Newtonian science a theory of knowledge. It is this aspect that links him to his successors. The *Principia* represents in the history of philosophy both a great gathering together of concepts, traditions, and problems from the past as well as a challenge to the future for further investigation.

Of the mathematicians and physicists that immediately followed and accepted Newton, and in England there seem to be few, if any, who did not accept his conclusions, none appear to have made important contributions to his concepts of space and time. In the lectures[21] delivered by John Keill (1671–1721) at Oxford in 1700 the method of approach is not different from the customary criticism of the Cartesian identification of space and matter. Furthermore, there is a belief in absolute space and time according to Newton. The theological implications of Newton's *Optics* finds a place but nothing further is done to improve either the mysticism of the account or to render the attributes more clear. The volume is a simplification of the *Principia* and is interesting as a textbook exposition of Newton for college students.

[21] John Keill, *Introduction to Natural Philosophy, etc.*, 5th ed. (London, 1758), see especially pp. 13–20 and p. 73 ff.

In 1702 Joseph Raphson (1648–1715) published *De Spatio Reali* which while not exactly an interpretation of the *Principia* falls into this group because of date, subject matter, and treatment of that subject matter. Raphson's major interest seems to have been mathematics and in this connexion he finds a place in the development of the calculus along with Newton. As the title of his book shows he wrote on space, and furthermore, he develops in great detail many of the questions raised by More. In this connexion it is interesting to find Raphson reproducing two of the arguments of the *Enchiridion Metaphysicum,* the rotating cylinder and the arrow, even to the extent of using the same engravings.[22] The arguments are to the same end, i.e., space is a real entity, existing in its own right distinct from matter as the logical presupposition of mechanics. But of even greater interest is Raphson's deduction of the attributes of God from the attributes of space. The argument seems to run that "Perfection," whenever met with in things must have its source in the First Cause. Now infinite space is the presupposition under which alone we can speak of the existence of the limited, finite world of bodies, the bodies implied in mechanics. Infinite space is "Perfect" and therefore God must be its prototype. The spiritual can never come from the material so the extended can never come from the unextended, consequently God must be extended. Thus we find Raphson saying that:

> "Since the First Cause is the source of nothing which it does not contain in a more perfect manner in itself, with equal reason the questions can be asked, 'How can thinking substance be produced from non-thinking substance' and 'How can extended things come from what is not extended?'
> "In comparison with that Most Essential substance, objects are weak adumbrations of the true Reality, rather than themselves something real; for even were they everywhere (in infinite space) since they would contain being only as a manifold of particulars they would never attain the infinity of the supreme Cause, which is in the highest sense positive and real."[23]

The unconditioned is to be reached from the conditioned by freeing what is given to us empirically from every limitation of thought and so rising to an adequate intuition of absolute reality. The space of physics and mathematics is the easiest road. Here all the determinations which in material bodies we see in a troubled, broken light are contained in space in "purer and more spiritual form." Space is indivisible, yet the ground of all divisibility, immovable, yet the condition of every motion, homogeneous and simple, yet the presupposition of all particularization and mutual limitation of things. It is the *truest image* of the divine substance for:

> "Whatever expresses infinitude actual and most absolute in its kind, expresses the essential of the First Cause as necessarily existing and the Author of all that is."[24]

[22] Joseph Raphson, *De Spatio Reali* (London, 1702), pp. 63–67. Cf. More, *Enchiridion Metaphysicum* (London, 1671), ch. VI.
[23] *Op. cit.*, pp. 83 and 90.
[24] *Op. cit.*, p. 80.

Whether Raphson should be considered as more closely related to More than Newton depends somewhat on the weight given to Newton's theological interests. It is clear at least that this attitude toward space had wide currency and the work of Raphson is but one more bit of evidence of the tendency during Newton's lifetime to draw an analogy between space as the locus of natural phenomena and mathematical entities and God's attribute of extension. In this particular summation there is reason to believe, even as in the *Enchiridion Metaphysicum* of More, that more is intended than an identification of space with a divine attribute. There is the opinion that space is a manifestation of God's essence, a manifestation to be understood by all.

George Cheyne (1643–1671) attempts what might be called a mathematical analysis of space and time since in his work[25] it is emphasized that their infinity allies them to the nature of God. Their reality is not questioned but their importance is held to be less for mathematics and science than for theology. Sir Henry Pemberton (1694–1771) published in 1728 one of the most popular accounts of Newton and the work went through many editions. Its contents are entirely expository and no critical attempts are made on the material.[26]

However, in the work[27] of Colin MacLaurin (1698-1746) we find evidence of a much more subtle understanding of Newton as well as some grasp of the meaning of the postulates from which the Newtonian physics develops. The chapter treating "of space, time, matter, and motion"[28] begins with a discussion of knowledge, and MacLaurin goes to some trouble to point out the dualism subsisting between what is known and that to which knowledge refers. The first set of objects are the objects of perception which are relative to mind in the act of knowledge. The second class forms the system of scientific objects which are characterized as of such a:

> ". . . passive nature, that they never move of themselves, neither when they are in motion, do they ever stop without some external influence. If one of these move out of its place, without the appearance of a mover, we immediately conclude that this is owing to some invisible agent; so much are we persuaded of its own *inertia.* If we lay up one of them in any place we expect to find it there at any distance of time, if no other powers have had access to it. This passive nature, or *inertia,* is what chiefly distinguishes the second class of external objects, which is called *body* or *matter;* as the former is called *mind* or *spirit.*"[29]

Here in less than one page we have stated the complete theory of knowledge which underlies Newton's physics and which John Locke elaborates in his *Essay.* Here is present the great assumption of externality of scientific objects which by definition are passive and absolute. They are masses which can undergo no self-originated change as well as no change of essence. They are fixed,

[25] George Cheyne, *Philosophical Principles of Religion,* 3rd ed. (London, 1725), see especially pt. II, pp. 33, 48, 53–54, and 117.

[26] Pemberton, *A View of Sir Isaac Newton's Philosophy* (London, 1728), see especially pp. 112–116.

[27] Colin MacLaurin, *An Account of Sir Isaac Newton's Philosophical Discoveries,* 3rd ed. (London, 1775), The first edition was published posthumously in 1748.

[28] *Op. cit.,* p. 102.

[29] *Op. cit.,* pp. 102–103.

definite, and immutable and form the system of causes which alone were deemed adequate to explain the existence of our ideas.

After this introduction MacLaurin turns to the definitions of space, body, time, and motion. In his treatment of these concepts he follows Newton quite exactly and his remarks repeat only what has been said before. However, in the general discussion of absolute space which follows this more formal exposition a new aspect of the problem begins to receive emphasis. The section opens with a possible allusion to Berkeley.

> "I know that some methaphysiciams of great character condemn the notion of absolute space, and accuse mathematicians in this of realizing too much their ideas; but if those philosophers would give due attention to the phenomena of motion, they would see how ill grounded their complaint is."[30]

What can be learned from a study of motion that can make absolute motion and absolute space clear and intelligible? In the first place, we mean that the uniform motion expressed in Newton's first law is absolute motion since this motion refers to the inertia of bodies which by definition is essential and absolute. Consequently it is only those:

> ". . . who are not well acquainted with the theory of motion, [who] more easily allow that a body at rest continues at rest, in consequence of its passive nature or *inertia,* than that when in motion it continues in motion: *but this perseverance of a body in a state of rest can only take place with relation to absolute space, and can only be intelligible by admitting it.*"[31]

It is in this passage that we see emphasized quite clearly the logical nature of Newton's absolutes. As we mentioned above in the discussion of the "pail experiment" if the first law of motion is once granted with its assumptions about the nature of body, absolute space and time are the necessary consequences. It is to the credit, however, of MacLaurin that in his exposition of Newton he was able to realize that space and time as absolutes are the logical requirements of this physics. In this respect MacLaurin approaches the *Principia* with a very different point of view from the other expositors, although he does not develop his interpretation beyond this stage.

In general the conclusions that Newton reached seemed satisfactory and final to English science and for further speculation on space and time by men primarily engaged in physics it is necessary to return again to Continental investigations. In Newton we find our first great summation for English thought, a summation that remains comparatively unchanged for many years, but a summation that applies largely to science. In respect to space and time the first English thought on this matter seems to have grown out of a protest against the Cartesian physics. Following on this protest there developed in More a theory of space rich in theological implications but also having relevancy for

[30] *Op. cit.,* p. 107. This is of some historical interest since references to Berkeley at this period are rather unusual. Cf. also *Op. cit.,* p. 103, "It is, however, rating our ideas of external objects by much too low, to compare them to words or arbitrary signs, serving only to distinguish them from each other."

[31] *Op. cit.,* p. 108, italics mine.

philosophy and science. Approaching the question from the position of mathematics we have noticed the changes Barrow introduced and the complementary treatment of time. But little later than the work of these men we have the *Principia* which regards the problem for physics but at the same time pays strong deference to the theological aspects of the problem. But there is even more than this in the physics of Newton. As we have noted there is primarily the English reaction to intellectual problems, and the discipline worked out reflects the opinion and reactions of English thought. The answer that English science gives for space and time finds its final and full development in Newton and in this answer the further implications are to be taken up by philosophy and theology. For philosophy the problem finds full expression in the work of Locke and as we shall see in the next chapter there is strong reason for believing that the *Essay* fills for English philosophy a position of equal importance with the *Principia* as the answer for physics. But the theological ferment begun by More has yet to develop completely. After Locke this phase of the matter comes to full development depending for its authority in physics on the *Principia,* for its authority in mental philosophy on the *Essay.* It is now our task to investigate what seems to be the more strictly philosophical account of space and time as unfolded in Locke's work followed by an account of the theological difficulties that resulted from the conclusions of both Locke and Newton. In the end we shall note the criticism that both of these great summations received in the work of Bishop Berkeley.

CHAPTER V

JOHN LOCKE

As we have seen in the preceding chapter, Newton was successful in devising for seventeenth and eighteenth century science a satisfactory formula for explaining the world postulated by this science. It was a world composed of mass in motion, this mass being identified with the ill analyzed notion of matter or substance, while motion was to be understood as translation of this matter in space, the motion being either absolute or relative depending on the character of the space to which that motion found reference. Also another entity is introduced—time—which like space may be either absolute or relative. From these three all phenomena may be deduced, matter forming the substantial constituent of phenomena, space a place for these diverse phenomena, and time, although not in the Aristotelian sense a measure of motion, a means whereby the rates of change of these same phenomena may be measured. The emphasis throughout such a science is on the observed, and the purpose of such a science will be to explain the observed changing patterns of matter as they occur in space and time. From these continued observations it will be ever possible to refine the results obtained as well as extend our knowledge to those parts of this world not brought as yet into consistency with the general scheme. Consequently, if in Newton and Newtonian science we find all emphasis placed on that which may be observed, we find developed in John Locke (1632–1704) an interest which purposely restricts itself to a very different, and in many ways more difficult, problem; the relation that subsists between this world as described by science and the observer.

At the start it is worth noting, because it is obvious, Locke's first great presupposition, since this assumption as a point of beginning influences profoundly his epistemology. Locke assumes without proof and almost without critical mention the world as postulated by Newton's physics. The problem to be discussed is not the validity of such a physical account, for the correctness of Newton's answer is assumed, but the possibilities and limits of knowledge in such a world. Furthermore, one other problem is to be neglected, not this time because a final answer has been reached but because the difficulty is purposely placed to one side as not constituting an essential part of Locke's greatest interest. This is the status or place that mind might find as that term in the relation of knowing which is to be set over against that which is known, or in other words the nature of that before which the object of knowledge is placed is not to be discussed. The problem that Locke sets for solution is narrowed to an exhaustive consideration of the relation between an external world, the world conclusively formulated by science, and another world, the realm of mind which at that time still lacked the beginnings of very fruitful investigation from the point of view and in terms of the method of the new science. It is important

to note here that in the very formulation of the problem as stated above a third assumption occurs of no less importance than the other two since to introduce a world which is by definition other than and external to mind places upon the theories that may follow a burden which may even exceed that arising from an acceptance of the Newtonian physics although this last obligation seems clearly to have its roots in the first.

In this outline of Locke's problem of knowledge certain factors come to light before the problem *qua* problem is definitely attacked. In the first place, the epistemology is to be based upon a psychophysical dualism, a dualism that intends the physical to represent a class of objects quantitatively and qualitatively separate from a second class of objects. As physical the objects have been fully accounted for by physics but in the account that physics has given all of being has not been explained. There is a certain remainder and in so far as the division is one of mind and body all of this remainder will constitute a second class of objects or mind. The nature of this second class, since it has not been investigated and is not to be investigated in the terms then current for science, cannot therefore be shown conclusively to be other than the class of physical objects. However, as we have said, the assumption is made that they are different.

If this is Locke's first dualism we have not long to wait before encountering a second and this time a dualism of the greatest importance for his theory of knowledge if indeed it does not constitute the essence of that problem as it arises in Locke's philosophy. Before attempting to state and examine directly what is dual here it may be well to give the argument leading to it or at least the assumption on which it is based. This assumption seems to be that in some way this second dualism is dependent for its meaning on the first. To this extent there is argument from psychophysical to epistemological dualism, an argument not explicitly stated but nevertheless used. The need for such a transition is hard to understand for when we turn to examine what is postulated as dual in epistemology we discover that the object before the intellect is numerically and qualitatively different from some other object postulated as its cause, cause according to the usage of Newton's conception of mechanics. So then, there appears to be no sufficient reason for concluding that because the object before the mind is other than its cause, that the mind itself is other than the class of scientific objects since the entire argument appears to depend on an inextricible confusion of mind, mental object, and matter treated as analogical classes. The solution of Locke's mind-body problem may well be regarded as distinct from a solution of his epistemological problem and neither in any sense determined by a solution of the other. For these reasons we may leave the question of mind and body and center our attention upon the other problem, that is to say, the nature of the relation that subsists between mind, whatever this term may prove to be, and the external world whatever this world may be.

The answer to this question is almost too well known to bear repetition. It seems reasonably clear to believe that on Locke's assumptions in any act of knowledge we find three factors or terms of importance. There is the class of scientific objects or that portion of being which constitutes the real subject matter of Newtonian science. In this realm of absolutes, where

objects themselves undergo no internal changes but only a change of external relationships, experience finds no place. It is a world definite, isolated from "mental" factors, subject to mathematical description and by implicit definition inferred, the inference, however, becoming more and more certain as an increasing body of phenomena receive explanation. Translated into Locke's terminology it becomes that class of objects which are the efficient mechanical causes of experience although in themselves they are outside of experience in the sense that nothing in their nature is contingent upon the fact that they bear a certain relation to mind. Because of them mind has ideas and indeed two varieties of ideas. In the first place, there are the ideas of primary qualities which are best understood as the ideas of properties inhering in those bodies which constitute the system of scientific objects. This constitutes a certain type of relation subsisting between mind and scientific object, a relationship which renders to mind ideas of properties of scientific objects. Secondly, there are the ideas of secondary qualities. These are explained as arising because of the subsistence of a certain relationship of object to mind, only here, the ideas are of something other than the properties of the scientific objects. Although ideas of these two varieties are caused by scientific objects and are similar in this respect, nevertheless, they have an important difference. In the idea of a primary quality there is reference to a property existing independently of mind while with ideas of secondary qualities these qualities are contingent upon the act of knowledge. Also both sets of ideas have at least two other important aspects of similarity for they are relational and they are the content of what is before the mind in any act of awareness. It is in this second sense that they may be called empirical objects if by empirical we mean that which fills experience and thus constitutes a class which by definition is differentiated from other classes because it is known. However, we are not to forget that the empirical object is distinct from the scientific object both quantitatively and qualitatively, that is to say, it is both numerically other than the scientific object and by its behavior is unfitted to enter into the context of the objects of science. We find separated two completely disparate sets of entities, the first providing science with the basis for its hypotheses, while the second is to bear the weight of explaining how knowledge is possible as well as what knowledge is possible.

From this preliminary sketch let us turn our attention to the account that Locke has prepared of space and time, giving particular care to an examination of the conclusions Locke reached, as well as to any dualism in space and time corresponding to the dualism of scientific and empirical objects. It will be necessary to compare the conclusions that Locke reached with those of Newton and More since there seems to be good reason for believing that a definite tradition connects these men and that in many ways the changes they represent but indicate a rather great concurrence of opinion on the nature of space and time, their differences being most easily explained as different applications of space and time to different aspects and fields of thought.

An examination of Locke's papers, as edited by Lord King,[1] discloses that

[1] Lord King, *The Life of John Locke, etc.* (London, 1829).

Locke first recorded his speculations on space in 1676.[2] At that time, he was of the opinion that space could best be understood from the rather phenomenalistic level of Hobbes by whom he appears strongly influenced. The nature of space is to be understood psychologically as an intangible and thoroughly ephemeral construct of mind. The space that we imagine has no more reality than some fairyland, for if all were destroyed, both space and the world of experience, we could still bring before our minds a figment of that which once had real existence. Space is considered void of reality unless there is something that possesses extension. It is now that the authority of Descartes appears, for Locke seems inclined to identify the realness of space with the realness of matter as extended. Indeed, the similarity is carried yet further for a comparison is drawn between the characteristics of space and number. The conclusion is entirely nominalistic for to neither number nor space is reality granted unless there is something either to be numbered or extended. Number is a "mental" abstraction that can be applied to anything whatsoever while space represents the fact that bodies may be logically considered as extension *per se*.

In spite of the tone of this passage[3] which seems to indicate that Locke disbelieved in a space possessing the same reality as matter yet existing apart from matter he has not produced any serious ground of disproof. Throughout, the contention has centered around "imaginary space" or space as an "image" so that by definition the reality of space is denied at the start, if the reality attributed to space is the same as that attributed to matter.

A year later[4] (1677) Locke has to some extent advanced a different theory. He now speaks of space as the "capacity or possibility for extended beings or bodies to be, or exist."[5] Continuing from this approach he goes on to say that we are not to consider this capacity as something real and existent since it does no more than form the possibility for body to exist now here, then there. Space, as capacity, provides a place for body but does not exist in the same sense as body nor does Locke seem to intend that there is any possibility of identifying space with body. It is emphasized that space only acquires actual existence and meaning when considered in conjunction with body. At this stage the tendency toward the Cartesianism of the previous year has lessened for we do not discover the extension of body identified with space. This becomes more clear when we discover that by distance Locke means the relation subsisting between two bodies when they are considered as, "near or remote to one another."[6] Distance is made to depend entirely on two bodies related, "for were there no beings at all, we might truly say there were no distances."[7] But even so, there is a tendency to confuse the distinction between distance and space for we find that "space" is loosely substituted for "distance" and is denoted, "a bare relation."[8] In spite of this Locke

[2] *Op. cit.*, pp. 62–63.
[3] *Op. cit.*, pp. 62–63.
[4] *Op. cit.*, pp. 329–331.
[5] *Op. cit.*, p. 329.
[6] *Op. cit.*, p. 329.
[7] *Op. cit.*, p. 329.
[8] *Op. cit.*, p. 330.

admits the possibility of "conceiving" space without body since the concept of space cannot be bounded.[9]

The mind has the power to imagine body created and placed in space without moving or destroying any body previously situated. It is here that Locke raises for himself another question which shows rather clearly the influence of Henry More. It is a question as to the limits the mind can reach in its powers of conception. In the first place, there is the possibility that the mind can imagine all body removed from a particular place. If this be so the space that presents itself to the mind does not possess reality but only represents the capacity previously discussed. Space from this aspect is the possibility of place and distance which in turn are relations deriving meaning from the existence of body. However, there is a second possibility for it may be true that the mind cannot conceive of this capacity as capacity or as Locke would say "pure nothing." In this eventuality Locke suggests that what our mind does apprehend is, "something belonging to the being of the Deity."[10] But even so, regardless of whether this conception represent capacity or an attribute of God, we are to understand that for its derivation and construction we have depended on sense experience, acquiring from the varieties of body known an idea of extension. Whether or not this idea of extension is to be considered "empty" or "filled" Locke does not decide. If "empty" then space:

> ". . . seems to be mentally separable from body, and distance nothing but the relation of space, resulting from the existence of two positive beings; or, which is all one, two parts of the same being."[11]

However, this opinion does not seem totally convincing to Locke, so it is balanced with the alternative, the decision being left to the reader, that:

> ". . . if it be a necessity to suppose a being there, it must be God, whose being we thus make, i.e., suppose extended, but not impenetrable."[12]

The year which separates these two speculations (1676–1677) contains rather important changes in Locke's general attitude. There has diminished quite noticeably the influence of Hobbes with space as a "phantasm" of the mind as well as the conclusion of Descartes that space and the extension of matter are one. In place of these opinions there has been an increasing tendency to consider space a means of explanation for the position of body and the distances between bodies. In doing this Locke has sacrificed some of the earlier nominalism for logical realism. But it is little more than a tendency for the reluctance, to consider capacities or possibilities real, is very great. Even so, there has been some increase in the existential values of such objects as the mind abstracts from the stream of things appearing before it. This appears most flagrantly in the willingness to admit that the mind has knowledge of such objects and although their derivation is strictly empirical and mediate, nevertheless, they are admitted as constituting a certain part of what can be known. It is also of interest to note that in considering distance Locke has raised the

[9] *Op. cit.*, p. 330.
[10] *Op. cit.*, p. 331.
[11] *Op. cit.*, p. 331.
[12] *Op. cit.*, p. 331.

question of the dependence of space on body not this time as extended but as related. There is now a suggestion that the relation subsisting between bodies may constitute space while previously space was by definition nothing more than the extension of body.

More startling, though not necessarily more important, is the internal evidence that Locke has read Henry More. As we have already seen the description of space as the divine extension forms the culmination of the *Divine Dialogues*. The philosophic pathway from Hobbes and Descartes to More is direct and short so that it is not surprising to find Locke seriously entertaining as an alternative possibility some connexion between space and the amplitude of God. Indeed, it is probably not too much to suggest that such a coupling of attributes is widespread throughout the thought of the seventeenth and eighteenth centuries. Furthermore, there is present in Locke's work of this year (1677) a tendency to call space an abstraction and then to give to this abstraction reality. Consequently, we are somewhat prepared for an identification of God's extension with space. God's attributes seem to provide at the start a necessary and unquestionable group of realities which are open only to the conceptive powers of intellect. To class space as one of these means a partial answer, though largely analogical, for the nature of space. It is an answer which identifies space with a class of objects which as God's attributes are not open to serious examination if this examination tends toward disbelief in their reality. Thus, Locke may have been dissuaded from complete assent to More's conclusions. It suggests for space indubitable reality, a thing Locke is not yet ready to admit for it required too great assent to a rationalistic tradition against which was directed the entire weight of the *Essay*.

But Locke provides us with a third stage of preparation before we turn to his finished opinions. In the papers of the next year (1678)[13] we find him definitely attacking Descartes by drawing a distinction between extension and distance. Extension denotes the distance or space between the extremities of body while distance or space *per se* should only be used to mean the relation between two or more bodies.[14] To this extent he is consistent with his view of the previous year though differing from 1676 as we have shown. There is now mentioned an important criterion to make this distinction good and the refutation of Descartes complete. Although we discover that body may be repeatedly divided into parts that may be separated one from another, space will admit of no such division for it is impossible that one part of space should ever be set off from another.[15] With this preparation, Locke seriously undertakes to set forth a relational view of space:

> "To my supposition, that space, as it may be conceived antecedent to, and void of all bodies, or, if you will, all determinable beings, is nothing but the idea of the possibility of the existence of body, for, when one says there is space for another world as big as this, it seems to me to be no more than there is no repugnancy why another world as big as this might not exist, and in this sense space may be said to be infinite;

[13] *Op. cit.*, pp. 331–335.
[14] *Op. cit.*, p. 332.
[15] *Op. cit.*, p. 333.

> and so in effect space, as antecedent to body, or some determinate being, is in effect nothing."[16]

If it is objected that such a view of space denies the category of quantity it is replied that quantity applied to space unrelated to body is meaningless since our ideas of measures of distance are no proof that these measures have objective validity and can be utilized on all subject matters. Distance is applicable only to bodies, either considering them as extended or as relative to one another. It is incorrect to think of distance as space when this space is devoid of content since the meaning of distance is only realized as applied to the contents of space.[17] It is worth noting that at this period Locke does not develop further or even mention the possibility that space may have some connexion with or meaning for the extension of God. The influence of Henry More as well as that of Descartes and Hobbes seems to be much in the past. There is an increasing interest in attacking the problem from the point of view of the "origin of ideas" as well as an insistence that space can be no more than an abstraction which, while logically prior to body, can only partake of meaning and be open to knowledge in so far as it is thought of in relation to matter. As we shall see in a moment Locke's opinions were greatly modified before the composition of the *Essay*. But at this time there has been not a little wavering between the rationalism which seems always to have been more at home on the Continent and the nominalism which often appears as a rather English product. That the decision for the present is in favor of the non-reality of space cannot be doubted nor has it as yet been made at all clear what position space would occupy in Locke's epistemology.

In conclusion there seems some reason to feel that Locke during these three years attacked the problem in a very desultory way, more as a curiosity in speculation than as an important problem to be solved. Of course he has investigated the three leading contemporary opinions but even these he has not criticized very thoroughly or very fruitfully. His own conclusion seems to represent in a large measure suspension of judgment for it is hard to take as conclusive an answer that insists on the relationality of space when no more of the properties of this relation are investigated than Locke pursues in these papers. Let us turn to his final answers bearing in mind the relation of these answers not only to the steps that lead to them but also the connexions that this part of the *Essay* has to his epistemology and the conclusions of Newton.

The problem of space is first seriously attacked in the thirteenth chapter of the second book[18] where the discussion opens with a classification which denotes space a simple idea with various simple modes. Concerning the origin of this simple idea Locke has spoken previously[19] in connection with solidity, striving to show:

> ". . . that we get the idea of space, both by our sight and touch, which, I think, is so evident, that it would be as needless to go to prove that

[16] *Op. cit.*, p. 333.
[17] *Op. cit.*, pp. 333–334.
[18] John Locke, *An Essay Concerning Human Understanding*, ed. by A. C. Fraser (Oxford, 1894). All references are by book, chapter, and section to this edition of the *Essay*.
[19] II. 4.

men perceive, by their sight, a distance between bodies of different colors, or between the parts of the same body, as that they see colors themselves; nor is it less obvious, that they can do so in the dark by feeling and touch."[20]

Once we are provided with this idea we make use of it in various ways and call it by different names. In the first place, we mean by distance the "length between any two beings, without considering anything else between them,"[21] while through the addition of length to breadth to thickness we obtain "capacity." To each idea of different distances Locke gives the name of "mode" and classifies this "mode" as simple since it refers to space previously regarded as a simple idea.[22]

With the introduction of the word "mode" Locke raises a new question of great importance in connexion with space. In the first place, by "mode" as a generic term Locke means entities that are not, "subsisting by themselves, but are considered as dependences on, or affections of substances,"[23] while when the term is specified as "simple" we are to understand the "mode" as referring to, "variations, or different combinations of the same simple idea, without the mixture of any other."[24] Filling out this classification with the various properties of space we discover that distance has the peculiarity of endless multiplication by the mind leading to the formation of the idea of immensity.[25] In such an idea the mind has transcended particularity, such as a specific distance between two given bodies, and forms an idea of distance in general in such a way that any amount of enlargement is possible.[26] Of similar kind is the idea of figure where the mind is able to join in endless variety the abstracted boundaries of bodies into an infinite variety of forms.[27] So also is the idea of place in which the mind considers the relative distance between bodies for the purpose of locating one or more bodies with respect to others.[28]

Of even greater interest to Locke is the definition of extension since this provides an opportunity to show the falsity of the Cartesian answer. Without change, in this respect, from the earlier papers the attempt is made with great care to show the distinction between body and extension. Three arguments are advanced to support the contention that an idea of body is other than an idea of extension. First,[29] the idea of extension includes no idea of solidity, "nor resistance to the motion of body." Secondly,[30] the parts of space are such that they cannot be separated from each other, while thirdly,[31] and dependent upon the second argument, the parts of space are immovable.

The account so far has been one of formal arrangement and genetic origin.

[20] II. 13.2.
[21] II. 13.3.
[22] II. 13.4.
[23] II. 12.4.
[24] II. 12.5.
[25] II. 13.4.
[26] II. 13.5.
[27] II. 13.6.
[28] II. 13.7.
[29] II. 13.12.
[30] II. 13.13.
[31] II. 13.14.

Once having before the mind an idea of space we are then able to form out of this idea various modifications which lead to other concepts. Space fills a dual rôle. As acquired through sight and touch it exists for the mind as an irreducible element out of which the activity of mind can form concepts. Throughout this section Locke seems to be attempting a division of space into perceptual and conceptual. As concept space appears under the ideas of distance, immensity, capacity, and extension since these are in some sense contributions by the mind to the elements of experience though once the mind has constructed these modes they become as much a part of experience as the original starting point from which they were formed. Space as percept, on the other hand, is something of which the mind is merely aware and at no time enters constructively into its formation. Considered from this point of view, the relation between space and mind in the act of knowledge is entirely external in the sense that the terms of the relation are in no way changed because they are related. But for Locke the mind does not exhaust its function in such a passive rôle, for from its *a priori* ability to compare[32] and add it builds up other forms which it then in turn refers to in the same way as the merely experienced.

It is quite obvious that the success of this distinction is not very great for in a large measure it depends upon a wavering uncertainty of just when the act of knowledge is internal and when external. That Locke was unable to decide this satisfactorily seems to provide one of the great ambiguities and points of confusion which have been often noticed in the *Essay*.

With these preliminary matters arranged Locke is ready to undertake a more searching inquiry into the exact nature of space. Having previously classified the idea of space as a simple idea[33] it is not surprising to find it is indefinable, for to say:

> ". . . that extension is to have *partes extra partes*, is to say only, that extension is extension."[34]

The situation is no better if space is defined as body for the dilemma arises that:

> ". . . either this space is something or nothing, if nothing be between two bodies, they must necessarily touch; if it be allowed to be something, they ask, whether it be body or spirit?"[35]

or if space be defined as substance or accident[36] the definition gives no intelligible information since Locke is unable to form a distinct idea of substance or of accident.

For Locke the idea of space, due to its simplicity, cannot be identified with anything else, it is unique, in a class unto itself and thus indefinable. However, it is probably not out of place to inquire into the reasons for this simplicity, nor should our inquiry be very difficult when we recall that all simple ideas are

[32] II. 11.6.
[33] II. 13.2.
[34] II. 13.15.
[35] II. 13.16.
[36] II. 13.17.

logical ultimates which cannot be analyzed into other terms, for members of the class of simple ideas have the property of:

> ". . . being each in itself uncompounded, contains in it nothing but *one uniform appearance, or conception in the mind*, and is not distinguishable into different ideas."[37]

Also there is one other point of rather great interest. Not only space, but time, as well as mass,[38] extension, figure, etc.,[39] are to be recognized as members of the class of simple ideas. When we recall the *Principia* we discover that Locke has adapted Newton's ultimates to his own uses, now calling them simple ideas but keeping them unchanged in respect to their nature as the last terms in a logical analysis. The simple ideas of space as well as of time occupy in Locke's account the same position that they did in Newton's in so far as they are "absolutes" which cannot be reduced or transformed into other terms. Yet there is at least one difficulty in Locke's point of view. In the definition of "mode" which we have already quoted it was stated that "substance" was to be understood as undergoing changes or modification giving rise to "dependences" or "affections" which are denoted either simple or complex. If now it is denied that space can be understood as substance Locke is forced to explain in what sense space is not "substance" and if it is not "substance" how it is ever possible to have "modes of space" unless the meaning of mode is rather fundamentally revised.

At this point the argument takes a new turn and is concerned with showing that beyond all doubt we do have such an idea clear and distinct from all else. To this end four arguments are advanced. The first[40] rests upon the assumption of the finitude of matter, this finitude being postulated as undeniable and certain. The question is then raised, if a man were put at the extremity of matter could he not stretch out his arm beyond the sum total of matter on the periphery of which he was located? The answer is obviously in the affirmative and from this Locke concludes once more that space is something other than body as well as something to which the mind cannot set boundaries. The second[41] is derived from God's power to create a vacuum and the intelligibility for intellect of the vacuum formed. The third[42] insists upon the necessity of space for motion, while the fourth[43] returns to the criticism of the impossibility of considering body and extension one. Beyond all doubt, for Locke at least, space is a distinct idea of which the mind is aware. But this only very euphuistically informs us of the kind of existence Locke intends space to possess for it immediately brings us to the larger question of the existential status of ideas and the meaning of this term. An investigation of this question, probably the most important in connexion with the *Essay*, falls outside the limits of this study, and only a very brief exposition can be attempted. In short this seems

[37] II. 2.1.
[38] II. 4.
[39] II. 5.
[40] II. 13.21.
[41] II. 13.22.
[42] II. 13.23.
[43] II. 13.24.

to be, that while ideas have real existence their existence is wholly dependent upon the existence of two terms, minds and scientific objects. We have, on the one hand, a system of scientific objects related to each other, the members of this system in turn related either individually or in aggregates to ideas. In balancing contrast to this we have a system of minds which are not related to one another but are related individually to ideas, the same ideas which are mentioned above as related to scientific objects. The existence of ideas is contingent upon the existence of two terms, these two terms being discrete in all particulars from the systems of relations into which they enter whether these relations subsist between members of the same class or different classes. This is not to imply that contingency belongs to minds and the objects of science for it is quite possible to have both existing without the existence of ideas for by idea is meant a relation and a relation of a peculiar and unique sort. In so far as ideas are related to scientific objects they provide in some way or other a symbolic copy or representation of that to which they are related, i.e., in so far as Locke classified ideas as ideas of primary qualities. As for the ideas of secondary qualities they are related also to the objects of science but now the relationship does not involve the reproduction of qualities of scientific objects. But when these varieties of ideas are related to mind the relation is of the kind called knowing and they furnish the mind with the causal effects of the first relation, i.e., their relation to the entities basic for science.

Applying this interpretation to the idea of space in the light of the opening discussion of this chapter we find that perceptual space is an idea unique in kind which bears to mind the external relation called knowledge. In this case perceptual space is an empirical object which provides a place for all other empirical objects. It is objective and real in the sense that it is not a product of the understanding, in some way spun out by the intellect. Yet it is contingent upon mind because it is only knowable as idea. Since our awareness of space involves the awareness of objects in space and since these objects as known are ideas or empirical objects so space as empirical object provides a place for that which is before the mind. However, a difficulty is encountered when we consider the "modes of space." As already remarked the activity of mind enters into the formation of these concepts so that in the effort to provide the system with a conceptual space we encounter another set of objects whose distinguishing attribute appears to be an increase in "mental" qualities. This at once makes for the greatest trouble and confusion, for Locke neither explains how these second ideas of space can exist along with the previous kind nor what their contents can be. Their difference from the previous kind of ideas seems to be that they arise through an activity of the mind or that the relation they bear to mind is of a more "intimate" sort when the mind considers the nature of the simple idea of space so that once they are created they assume equal existential validity with the idea of perceptual space, in fact coincide with it and thus contain the same objects. But this does not end the uncertainty of Locke's opinion since as we noticed above all ideas are related to a world external to the mind or, in brief, a system of scientific objects. Yet the idea of space as empirical object has two aspects according to the relation idea bears to mind. As empirical object P. it is directly apprehended by mind but as empirical

object C., mind seems to have a greater part in its formation. What can we conclude? Does space as empirical object share with all other empirical objects external reference and if so do empirical objects as P. refer to something different from empirical objects as C.? If there is reference as we have strong reason to believe from Locke's treatment of other ideas what can we discover in this case concerning the nature of the thing or things to which the idea or ideas of space presumably refer?

We may recall that in the papers composed before the *Essay* we traced three stages of opinion, we are now confronted with a fourth, and what is far worse, a choice. The last paper confessed a relational view of space which is now rementioned together with another opinion which found favor in 1677, for we are told that:

> ". . . whether anyone will take space to be only a *relation* resulting from the existence of other things at a distance, or whether they will think the words of the most knowing King Solomon, 'The heaven, and the heaven of heavens, can not contain thee'; or those more emphatical ones of the inspired philosopher St. Paul, 'In Him we live, move, and have our being,' are to be understood in a literal sense, I leave everyone to consider: only our idea of space is, I think, such as I have mentioned, and distinct from that of body."[44]

Space as the cause of our ideas may consist either in the relations of body or it may be regarded as in some way constituting the infinite extension of God. Before examining these conclusions further let us turn to Locke's account of time after which both entities may be studied together.

The chapter on time opens in a manner quite similar to the one on space. There is the same classificatory division of time into simple idea and "modes" of this idea,[45] the latter being represented by the various divisions of time such as hour, day, year, eternity, etc. With this beginning, Locke attempts a discussion of the origin of the simple idea of time or the way in which the mind has become aware of what it recognizes as duration. This prepares the way for the more difficult problems of eternity and the metaphysical nature of time. As a solution of the more immediate question we learn:

> "It is evident to anyone who will but observe what passes in his own mind, that there is a train of ideas which constantly succeed one another in his understanding, so long as he is awake. Reflection on these appearances of several ideas one after another in our minds, is that which furnishes us with the idea of *succession:* and the distance between any parts of that succession, or between the appearance of any two ideas in our minds, is that we call *duration.*"[46]
>
> "That we have our notion of succession and duration from this original, viz. from reflection on the train of ideas, which we find to appear one after another in our own minds, seems plain to me, in that we have no perception of duration but by considering the train of ideas that take their turns in our understandings. When that succession of ideas ceases, our perception of duration ceases with it; which everyone clearly experiments in himself, whilst he sleeps soundly, . . . "[47]

[44] II. 13.27.
[45] II. 14.1.
[46] II. 14.3.
[47] II. 14.4.

The idea of time is acquired by regarding the succession of ideas before the intellect. Unfortunately, such a simple answer has exceedingly complex presuppositions. In the situation described, we are to understand that the mind, in some fashion not explained, is aware not only of the ideas before it but of the difference between two ideas; of the difference in a very direct and immediate sense so that it is implying much more than if the mind were first aware of blue and then aware of red. By implication the mind is aware of a third thing, namely, that red is different from blue. As complex as this may be for Locke there is a further consideration. In the idea of succession there arises a fourth subject for awareness, i.e., the mind not only considers difference but also finds order in the difference, stating that blue came before red and red after blue. In the awareness by the mind of blue and *then* red four different acts of awareness take place, these four acts admitting of subdivision into two classes; the presence before the mind of the ideas of the colors blue and red and also the ideas of the relations "different from" and "before and after." For an understanding of this passage the relation referred to in the last distinction is probably the most important since as we know Locke insists that the mind is immediately aware of relations[48] and in the awareness of serial order we have most clearly an ultimate unanalyzable simple idea. It is interesting to remember the difference this introduces between time and space considered as simple empirical objects. When aware of space it is awareness of space as such or awareness of the relation between two bodies considered as separate, the decision between these alternatives not being definite or final. With time, however, the relational aspect alone receives recognition and from the fact that one body appears after another is the mind made aware of an order in the successive appearances of bodies.

Having thus accounted for the simple idea which the mind has of time Locke proceeds to explain the uses which the mind finds for this idea and the ways in which it can apply it. Of first importance from this point of view is measure, for:

> "Having thus got the idea of duration, the next thing natural for the mind to do, is to get some *measure* of this common duration, whereby it might judge of its different lengths, and consider the distinct order wherein several things exist. . . . This consideration of duration, as set out by certain periods, and marked by certain measures or epochs, is that, I think, which most properly we call *time.*"[49]

However, as Locke points out in an earlier passage, the idea of duration as present to the mind is highly variable depending upon the indefinite rate of the flux of ideas.[50] It is for this reason that some measure other than changing ideas must be sought to serve as a standard for rate of change. The difficulties inherent in the search are very great for nothing can be found to measure duration but duration itself just as in the case of space the spatial alone can be used as a reference.[51] The time problem is different and more difficult for in measur-

[48] II. 2.5.
[49] II. 14.17.
[50] II. 14.9.
[51] II. 14.18.

ing spatial distances it is possible to keep at hand a definite part of space such as a foot, yard, etc. Nothing of this kind can be done for temporal distances; we are compelled to resort to some motion and that motion is chosen which possesses the smallest irregularities. For this reason mankind has utilized the periodic changes of the sun and stars although any other periodic change if it possessed no greater variation would do as well.[52]

At this point an important distinction is emphasized. The measure of time is not to be confused with time itself for motion and the periodic changes of bodies which serve to measure duration are other than duration itself. Or as Locke has put it:

> "We must, therefore, carefully distinguish betwixt duration itself, and the measures we make use of to judge of its length. *Duration, in itself, is to be considered as going on in one constant, equal uniform course,*[53] but none of the measures of it which we can make use of can be *known* to do so, nor can we be assured that their assigned parts or periods are equal in duration one to another; for two successive lengths of duration, however measured, can never be demonstrated to be equal."[54]

Time as we have mentioned above is something other than the convenient measures of time and in particular is to be distinguished from motion. But there is much more than this to the passage quoted. Duration by its very nature is such that it is impossible ever to know certainly that an accurate measure has been found for it. This happens because no two parts of duration ever exist simultaneously for comparison. But how does this difficulty arise in Locke's system which throughout attempts a high degree of nominalism? Because at this point there has been introduced, in a manner previously intimated for space, absolute time. The reason for this and the nature of this absolute must be postponed until the two absolutes are compared a little later. Possibly, it is sufficient to note here that again Locke seems to be working toward a division of time into perceptual and conceptual. The former refers to time as experienced, either from the actual mental changes of ideas, i.e., we *first* have a perception of red and *then* a perception of blue, or as experienced from the idea we have of a given body which *first* occupies position A and *then* position B. In this second case Locke is quite ready to point out the dependence that time as experienced has to space. The idea of time under this classification arises from the successive occurrences of empirical objects, for time as perceived can only have meaning and existence from the existence of objects before the intellect. From the contemplation of this simple idea derived from the changes of objects before the mind Locke evolves the various "modes of time," e.g., the various measures. It is now, when the mind has acquired these measures that its most important activity begins for it is able to apply these measures in all situations whether or not there is present to it any further material for the measures of duration. This results in a measure of time being applied backward or forward from the present as far as we wish. Also, this explains the

[52] II. 14.19.
[53] My italics. Cf. Newton, *Principia*, translated by Motte (London, 1729), Vol. I, p. 9.
[54] II. 14.21.

idea of infinity of time which arises through a combination by the mind of the measures of time with the idea of unlimited addition. Time as perceptual is merely experienced, but once obtained may be utilized by the intellect in many situations that in themselves afford no measure of duration.

But there is another idea of time, the real unchanging flow of which our measures give us but a dim insight and of which we can never have immediate but only inferred knowledge. Let us follow Locke into his comparison of "duration and expansion"[56] to see what further light is thrown on time and space as absolutes. The point of departure in this section is built on the previously demonstrated difference between body and extension and the infinity of this extension. Space is something in its own right to which boundaries cannot be set. Locke now joins to these conclusions with more firmness than before the conclusion so boldly advanced by More. There is a connexion between God and space:

> "Nor let any one say, that beyond the bounds of body, there is nothing at all; unless he will confine God within the limits of matter. Solomon, whose understanding was filled and enlarged with wisdom, seems to have other thoughts when he says, 'Heaven, and the heaven of heavens, can not contain thee.' And he, I think, very much magnifies to himself the capacity of his own understanding, who persuades himself that he can extend his thoughts further than God exists, or imagine any expansion where He is not."[56]

The treatment of time is similar both in the origin of the present conclusion and in that conclusion itself. Time has already been shown to be something other than motion or body in motion and its infinity has been derived by the same process as the infinity of space. It is not surprising, therefore, to find Locke adding that:

> "God, every one easily allows, fills eternity, and it is hard to find a reason why anyone should doubt that He likewise fills immensity. His infinite being is certainly as boundless one way as another; . . . "[57]

At this point it is fairly evident that Locke has reached a new stage of opinion as compared with the papers written previously to the *Essay*. Is there any explanation of the change that has taken place between that year and the publication of the *Essay* in 1690? We know two things definitely, the date of the publication of Newton's *Principia* and the interest that Locke had in Newton's work. Our examination of Newton in the previous chapter has already shown the theological implications that Newton attaches to space and time and the origin of these implications in More and Barrow. Furthermore, there was a tendency toward theological assumptions in the paper of 1677 under the influence of More which was temporarily abandoned the next year. It seems fairly certain for these reasons that the *Essay* has received its point of view as compared with the earlier papers from the scientific authority of Newton. The case becomes even clearer as we continue our examination of this chapter.

Time and space, as we have seen, are comparable as representing the exten-

[55] II. 15.
[56] II. 15.2.
[57] II. 15.3.

sion and duration of God. However, this does not exhaust the similarity for both may be regarded in so far as they are relative, i.e., local time or time as measured and local space or place, as points of reference in the unlimited expanse of absolute time and absolute space since:

> "Duration and space being in themselves uniform and boundless, the order and position of things, without such known settled points, would be lost in them; and all things would be jumbled in an incurable confusion."[58]

For this reason Locke distinguishes between the two kinds of space and time when he says that:

> "Within these two [infinite duration and infinite space] are confined, and by the observable parts of them are measured and determined, the particular time or duration, and the particular extension and place, of all corporeal beings."[59]

Consequently, it is within absolute space and time that we find relative space and time. The latter are derived by observation both of the ideas before the mind and the interval between bodies and are applied by the mind as answers to the question "when" and "where." These terms belong:

> ". . . to all finite existences, and are by us always reckoned from some known parts of this sensible world, and from some certain epochs marked out to us by the motions observable in it. Without some such fixed parts or periods, the order of things would be lost, to our finite understandings, in the boundless invariable oceans of duration and expansion, which comprehend in them all finite beings, and in their full extent belong only to the Deity."[60]

Thus at the end of Locke's treatise on space and time we discover the other important similarity to Newton, the distinction of time and space as relative and absolute. Not only is this distinction drawn to the same end in which the practical character of relative space and time are emphasized for measurement but the application of absolute space and time to "absolute" or scientific objects is also made. By this is meant that the absolute corporeal substances comprising the objects of science do in themselves imply the existence of absolute space and time for without these absolutes, as was pointed out in the chapter on Newton, it would not be possible to regard the system of scientific objects as supporting only external relations. Also, for Locke, relative space and time meet all the requirements they did for Newton with the addition of another function. Space and time as relative are also space and time as perceptual and from this aspect constitute a place and a duration for empirical objects. The question *where* the objects before the mind may be and *when* these objects exist is answered. The space and time of which the mind has ideas is the very space and time which is derived from those objects of which the mind also has ideas and forms the only knowledge ever possible. Empirical objects are in empirical time and space which is also the time and space which the mind utilizes for the location of objects. What now is the relation of this space and time to

[58] II. 15.5.
[59] II. 15.6.
[60] II. 15.8.

absolute space and time? Once more Locke may be compared to Newton in that neither succeeds in answering this question. As we have seen both identify their absolutes with God's attributes and there seems little reason to doubt the sincerity of the intention, or the conviction that this is in some measure the correct solution of the problem. In treating of these absolutes Locke's problem is more complex even as it was with the relative. Absolute space and time are made the place and duration of the same set of absolutes as they were in Newton. The objects of science as contrasted with the objects before the mind are in a space and time of their own and this container of objects for the efficient causation of the phenomenal and the known is in itself of the same obscure and inferred kind as the things that it contains and locates.

At the end we see affirmed once more the dual nature of space and time. As relative they are related to the changing and the phenomenal but as absolutes they partake of and express for us the attributes of divinity. Just as in Newton so in Locke we discover the impossibility of clearly discerning the difference between the two although it is possible to understand the factors that led both to postulate the existence of these absolutes. We have only to recall the key position of absolute mass in Newtonian physics and the complete assumption of the validity of this concept by Locke. It is evident again that once a system begins with mass as absolute there will follow absolute motion together with all the implications both necessary and sufficient for absolute time and space. Deny these and it becomes increasingly difficult if not impossible to preserve intact the corpuscular, material, externally related objects which are at once both the system of scientific entities and the cause of all knowledge as they are related by means of ideas or empirical objects to minds. Here in a large measure lies the root of Locke's most serious trouble. Once having assumed that knowledge is relational, he is confronted with the enormous problem of how such knowledge, and there is no other, can be possible and have value in a world of absolutes such as Newton described. From this point of view the problem set for solution is to reconcile a relational theory of knowledge to an absolute metaphysics. The eighteenth century had not long to wait before the attempt was made in the speculations of Berkeley. But before turning to this important work we must stop to consider the contemporary theological difficulties provoked by the views of space and time which we have been discussing.

Before bringing this chapter to an end it is probably well to add a few remarks about one of Locke's critics who in the past has received a rather unmerited lack of attention. John Sergeant[61] (1622–1707) published in 1697 his *Solid Philosophy, etc.*, which includes a detailed criticism of Locke's *Essay*. In Sergeant's remarks on Chapters 13–15 of Book II there is developed an attack on Locke's theories of space and time. In substance, the basis of Sergeant's criticism of Locke is a difference in interpretation of the meaning of idea. Somewhat in anticipation of Berkeley, Sergeant insists that ideas are the only

[61] For a very good account of Sergeant see Johnson, *The Development of Berkeley's Philosophy* (London, 1923), pp. 61–67 and 383–396. See also, Henry Lee, *Anti-Scepticism, etc.* (London, 1702), for further, though unimportant, eighteenth century criticism of Locke's *Essay*.

things the mind can know and that it is impossible to regard ideas as having meaning apart from perception. From this it follows that we are only to speak of our ideas of bodies and the modes of body. Thus we find Sergeant insisting that:

> ". . . we cannot have any notion of space, without including body, however we may have a fancy of it. And I as positively affirm, that space can signify nothing but body, according to such a mode called space or quantity."[62]

Consequently, to speak of an idea of space is to speak unintelligibly, for our ideas are restricted to ideas of body and Locke cannot justify any account of a perception of space for:

> ". . . to conceit that we can have an idea of space without body, whereas he [Locke] never had an impression or idea of space but what was in body and a mode of it, . . . is . . . to abandon the firm ground of all our knowledge."[63]

In this way Sergeant denies the possibility of knowledge of space as an entity distinct from body and existing in its own right, for:

> "In a word, since space is not of itself a thing, or *res*, it must and can only be *modus rei;* and therefore to fancy an idea of it, which excludes body is to make it a mode of nothing and consequently no mode."[64]

Thus Sergeant concludes that since we have no idea of space as such it is not possible to conclude that there is some existent to which the word refers.

In the criticism of Locke's theory of time Sergeant maintains that time refers not to the succession of ideas before the mind but to the continuance of the endurance of objects. It is asserted that:

> ". . . to endure is to be, which has steadiness and permanency in its notion; whereas succession is essentially change, and so rather opposite to duration or being."[65]

From Sergeant's point of view Locke has confused the notion of endurance with the notion of succession. Furthermore, changes in bodies serve to give us a much better measure of time than the succession of ideas.[66] Such time is for Sergeant the only time we can know since as in the treatment of space the mind is cut off from everything except its perceptions. Thus what Locke and Newton might call measured time Sergeant insists is the only time of which we can have knowledge.

[62] John Sergeant, *Solid Philosophy, etc.* (London, 1697), p. 55.
[63] *Op. cit.*, p. 56.
[64] *Op. cit.*, pp. 56–57. Cf. also pp. 173–186.
[65] *Op. cit.*, p. 189. Cf. also pp. 187–196.
[66] *Op. cit.*, p. 189.

CHAPTER VI

SAMUEL CLARKE

Our investigation so far has placed most emphasis upon the connexion that space and time speculation during the seventeenth century had with science and philosophy. In More, as we saw, there is a fuller treatment of space than of time, while the gap where time was concerned was largely filled by the work of Barrow. The answers that these men gave interpreted space and time as real and existent entities which were unique and not to be derived from any other thing having either existence or reality. This aspect of their theories might be roughly classified as of primary interest to metaphysics, at least to analytical metaphysics where there is the problem of discovering what separate kinds of being there may be for discourse and individual investigation. But these opinions have a second aspect, classified for identification as scientific. This refers primarily to a conclusion drawn from the already determined and defined reality of space and time and the absolutes and relatives of Newton. Their character as relative space and time is such that they are measurements of absolute space and time and as measurements they afford us knowledge of the natural world. Arising from this foundation is Locke's *Essay* suggesting many problems about knowledge and giving for space and time a new interpretation of the dualism inherent in the Newtonian physics. Space and time are still real in the sense that More and Barrow intended, and they are still dual in the manner implied in Newton's cosmology, but the terms have changed as the interest has shifted from the analytical metaphysics of the Cambridge Platonists and the science of the generation succeeding them. Space and time are now viewed from Locke's epistemological standpoint and give the answer to the "where" and the "when" of empirical objects and of the cause of these objects and of mind. That, for Locke, the object before the mind as the contingent and related finds its locus in relative space and time, while the objects of science and possibly mind are in absolute space and time, is not surprising in view of Locke's Newtonian background, their proper relief.

Now there is a third aspect of the problem which all four of the above investigators have treated with varying intensity. This is the theological importance of space and time as philosophy and science have treated them. In More there is the ever present urge to validate the claims of the immaterial, and we have already noticed the circuitous arguments that lead to a serious correlation if not identification of space with God's attribute of extension. Barrow makes a very similar attempt for time and God's attribute of duration. In Newton there is a recurring tendency to find in absolute space and time intimations of the divine attributes transmitted unchanged but for terminology to John Locke.

It is now our problem to examine more carefully what may be called the theological developments of space and time in the hope of explaining slightly

what may to us appear as nothing more than a peculiar form of religious faith or a rare kind of metaphysical piety. We begin with Samuel Clarke (1675–1729) who in some respects represents the first professional theologian to attempt an interpretation of God's attributes in the light of the new science. In the years 1704–1705 Samuel Clarke delivered a series of lectures under the recently established Boyle foundation publishing his work in 1705 with the title, *A Discourse Concerning the Being and Attributes of God.* In this there is little to interest us except the insistence that space and time are real and existent. The first argument depends on the inseparability of the parts of space, for to:

> ". . . suppose any part of space removed, is to suppose it removed from and out of itself. And to suppose the whole to be taken away, is supposing it to be taken away from itself, that is, to be taken away while it still remains, which is a contradiction in terms. There is no obscurity in this argument, but what arises to those who think immense space to be absolutely nothing, which notion, is itself likewise an express contradiction, for nothing is that which has no properties or modes whatsoever. That is to say, it is that of which nothing can truly be affirmed, and of which everything can truly be denied, which is not the case of immensity or space."[1]

To space Samuel Clarke will attribute real existence since space is subject only to logical division and not to an actual separation of parts. Furthermore, it is possible to build up positive propositions concerning space since attributes may be assigned to the concept. The value of these arguments when considered as proving for space a reality usually attributed to matter is rather hard to understand since the question of divisibility is well known to be the mother of antinomies while it is even more obvious that positive propositions apply equally well to the imaginary. However, let us assume the premises in order to follow the subsequent developments. In this connexion, it is interesting to notice the definitions of infinite space and infinite time:

> ". . . infinite space, is nothing else but abstract immensity of infinity; even as infinite duration is abstract eternity. And it would be just as proper, to say that eternity is the essence of the Supreme Cause; as to say, that immensity is so."[2]

It is clear at this point in Samuel Clarke's development that God's essence is not constituted by space and time just as it is equally clear that Clarke has established himself in the tradition of regarding space and time as somehow real entities. During this part of the period (1705) we discover that Clarke has accepted the authority of Newton and Locke as to the kind of existence space and time have, although as yet their relation to God has not been made clear. That they are denied to be God's essence is not surprising for it is rather hard to imagine a theology based on time and space. Of their precise relation to God we find Clarke's first account in a correspondence during the years 1713–1714 published together with a later edition of the *Discourse* in 1716. In the second letter of this series some light is cast both on the nature of space and in

[1] Samuel Clarke, *A Discourse Concerning the Being and Attributes of God,* 10th ed. (London, 1749), pp. 16–17.

[2] *Op. cit.,* p. 40.

consequence on the connexion that space bears to God. The argument now runs that:

> ". . . space is necessary to everything, and nothing can possibly be conceived to exist, without thereby presupposing space, which therefore I apprehend to be a property or mode of the self existent substance; [God] and that, by being evidently necessary itself, it proves that the substance of which it is a mode, must also be necessary, necessary both in itself and needful to the existence of anything else whatsoever."[3]

Space is necessary in the sense that it is required as a place for the existence of all things. However, an important conclusion is drawn from this necessity. Space is now postulated as a mode of substance and if this mode is necessary so is the substance of which it is a mode. In his next letter we find worked out more carefully the nature of this self-existent necessary substance of which space is the necessary mode, for:

> "All other substances are *in* space and are penetrated by it, but the self-existent substance is not *in* space nor penetrated by it but is itself. . . . the substratum of space, the ground of the existence of space and duration itself."[4]

For Clarke a self-existent necessary substance such as this must be God. The connexion between God and space and time is of a sort that makes God the ground of the existence of space and time; space and time have logical necessity in that they are modes of God's substance. But there seems to be a tendency to suggest that because of the rigorous necessity attaching to space and time which was pointed out in the second letter (Nov. 28) they are in so far forth a means of realizing the necessity of the self-existent substance or God. There seems suggested a kind of proof for God's existence based on the necessity of space and time which because they are necessary must point to an even more necessary ground as justification for their existence. Of relevance to this last point is the passage stating:

> "But that being, whose existence makes duration and space must be infinite and eternal because duration and space can have no bounds. Not that duration and space are the formal cause of that existence; but that necessary attributes do necessarily and inseparably infer or show to us a necessary substance of which substance itself we have no image because 'tis the object of none of our senses. But we perceive its existence by its effects and the necessity of that existence by the necessity of certain attributes and by other arguments of reason and inference."[5]

From this we receive a rather interesting indication of the influence that the new science was beginning to exert on religious speculation. The absolute space and time of the Newtonian cosmology has been accepted and defended

[3] *Several Letters to the Reverend Dr. Clarke, from a Gentleman in Gloucestershire . . . with the Dr's. Answers thereunto.* Bound with Clarke's *Discourse* 10th ed. and the pagination continued. Clarke's 2nd letter, November 28, 1713, p. 472.

[4] *Op. cit.,* Clarke's 3rd letter, December 10, 1713, p. 476.

[5] *Op. cit.,* Clarke's 6th letter, p. 493. Letters six and seven which terminate the series are replies to an unnamed correspondent who is not the author of the first five letters to Clarke. Only Clarke's replies are printed and they are not dated.

and from the presumed soundness of this cosmology and its space and time an argument has been devised to show that because of their indubitable necessity they give insight into the nature of God. It is a taking of the most general and universal in science as a point of departure for a theology and in this respect may well suggest many subsequent and even modern efforts at an alliance of science and religion.

However, Samuel Clarke has not reached the end of his speculations on these matters. In the years 1715–1716 there took place the discussion with Leibniz, their letters being published in 1717.[6] Since it is not the purpose of this investigation to include the theories of space and time current on the Continent the examination of this correspondence will be restricted to Samuel Clarke's contributions in an effort to make plainer his position both in the group of theologians with whom he has been classified as well as his part in the setting of the entire theological development of space and time theory as this unfolded in England during these years.

It is of great interest to remember that the discussion began over an interpretation and criticism of Newton by Leibniz[7] which the latter sent in a letter to the Princess of Wales. At the request of the Princess,[8] Samuel Clarke undertook a defense of his countryman and altogether five letters were composed on both sides, the discussion being terminated by Leibniz's death on November 14, 1716. In his first letter, Leibniz refers to Newton as saying:

> ". . . that space is an organ, which God makes use of to perceive things by. But if God stands in need of any organ to perceive things by, it will follow that they do not depend altogether upon Him nor were produced by Him."[9]

Samuel Clarke takes issue with this and explains that Newton meant that God as:

> ". . . omnipresent perceives all things by His immediate presence to them in all space wherever they are without the intervention or assistance of any organ or medium whatsoever."[10]

From this point on it is Samuel Clarke's intention to combat the relational theory of space and time advanced by Leibniz and show that they are real existing entities which somehow express the infinite extension and duration of God; in other words, to continue in this correspondence the point of view already adopted in the passages we have examined above.

[6] Samuel Clarke, *A Collection of Papers which passed between . . . Mr. Leibnis and Dr. Clarke* . . . (London, 1717).

[7] *Op. cit.*, p. v.

[8] *Op. cit.*, p. iii.

[9] *Op. cit.*, p. 3. Cf. Newton, *Optici*, 1st Latin ed. (London, 1706), p. 315 and *Optics*, 3rd English ed. (London, 1721), p. 345. This passage does not appear in the 1st English ed. (London, 1704), but I am told is in the 2nd English ed. (London, 1717). From the dates it seems clear that Leibniz bases his remarks on the 1st Latin ed. (London, 1706). Now we know that Clarke translated the 1st ed. into Latin. Thus there is a possibility that the statement quoted either had its origin in Clarke or was even written by Clarke. Even so, the passage must have been approved by Newton since it appears in the later edition.

[10] *Op. cit.*, p. 11. Cf. Newton, *Principles*, translated by Motte (London, 1729), Vol. II, p. 389 the *General Scholium* added in the 2nd ed. of the *Principia* (London, 1713).

At this time Samuel Clarke seems to put most emphasis in his proof of the real existence of absolute space on an argument previously favored by Newton which depends upon a distinction between the different kinds of motion. In his fourth letter to Leibniz the point is developed that:

> "The motion of the ship, though the man perceives it not, is a real different state, and has real different effects, and upon a sudden stop, it would have other real effects. . . . To this argument no answer has ever been given. It is largely insisted on by Sir Isaac Newton in his mathematical Principles (Definit. 8) where from the consideration of the properties, causes, and effects of motion, he shows the difference between real motion . . . and relative motion. . . .
>
> The reality of space is not a supposition but is proved by the foregoing arguments. . . ."[11]

But as before this real space as well as real time are viewed as God's attributes for:

> "Space void of bodies, is the property of an incorporeal substance.[12] Space is not bounded by bodies, but exists equally within and without bodies. Space is not inclosed between bodies; but bodies, existing in unbounded space, are, themselves only terminated by their own dimensions.
>
> Void space is not an attribute without a subject, because, by void space, we never mean space void of everything, but void of body only. In all void space, God is certainly present, and possibly many other substances which are not matter. . . .
>
> Space is not a substance but a property, and if it be a property of that which is necessary, it will consequently . . . exist more necessarily . . . than those substances themselves which are not necessary. Space is immense and immutable and eternal, and so also is duration. Yet it does not at all from hence follow that anything is eternal *hors de Dieu*. For space and duration are not *hors de Dieu*, but[13] are caused by, and are immediate and necessary consequences of His existence. And without them, His eternity and ubiquity (or omnipresence) would be taken away."[14]

It must be said in defense of such a long quotation that here we find a rather interesting summation of one theological attitude at this period. Although the letters are primarily a defense of Newton's ventures into philosophy they afford at the same time an insight into Samuel Clarke's own position as this affects theology. It is in fact an appeal to the authority of Newton, somewhat colored by an infiltration of the ideas of More and Barrow, for a substantiation of a speculation concerning the nature of God. To the generation of Englishmen contemporaneous with Samuel Clarke probably nothing seemed a more certain and true insight into the nature of things than Newton's *Principia*. So that again there seems a strong likelihood that the interest which led Henry More to give to the immaterial the same validity as the material has influenced Samuel Clarke in attempting to show that the claims of "natural religion" are best sub-

[11] *Op. cit.*, pp. 133–135. Cf. Newton, *op. cit.*, Vol. I, p. 9.

[12] Cf. Henry More, *Divine Dialogues*, 2nd ed. (London, 1713), pp. 52–60.

[13] Clarke refers to and quotes in a footnote part of Newton's *General Scholium*. See Motte translation of *Principles* (London, 1729), Vol. II, pp. 389–390.

[14] *Leibniz-Clarke Papers*, pp. 127–131.

stantiated as founded on the postulates of science. To this extent some explanation is given for the neglect of Locke in Samuel Clarke's account although the thorough-going rationalism of the latter is probably the most fundamental reason. Even though in Locke we find the other great source of authority his conclusions were not of a kind that could be considered as free from differences of opinion as the work of Newton. Furthermore, as we said in the last chapter, Locke depends in many ways on the work of the new science so that when Samuel Clarke returns to Newton he has in some respects adopted the safest course; for if it could be shown that cosmology and religion both depended upon the same assumptions and developed from different aspects of the same entities then any question of difference between science and theology seemed resolved into a difference in emphasis. When we add to this the reflections of Locke's *Essay* we probably achieve as much order and precision both of whole and details as even the eighteenth century might have desired.

In the years between the publication of the *Leibniz-Clarke Papers* and 1731[15] two volumes were issued which treat of the conclusions of Samuel Clarke. In 1718 Samuel Colliber (fl. 1718–1737) published his *Impartial Inquiry into the Existence and Nature of God* where among other things he attempts to defend the reality of space and time and define their meaning as God's extension and duration. For his point of departure he depends largely upon Locke since distance is to mean the relative idea of space between two points.[16] From this idea of distance the mind derives its idea of space which idea is to be taken as absolute in contrast to the idea of distance which is relative in the sense that it depends upon two or more located objects. This idea which we have of space is simple and because of this simplicity Colliber believes we have a reason for difficulties of exposition about space.[17] After this introduction the argument insists that three prejudices about space must be overcome:

1. It is absolutely infinite.
2. It is not real and distinct from body.
3. It is accidental to Being in general.[18]

After a short discussion of the first two points in which the customary anti-Cartesian arguments are advanced, Colliber concludes that rather than indulge in the multiplication of entities and regard space as something other than matter and spirit it is more Christianlike to hold that this immaterial extension is God who pervades all.[19] But this would not mean parts in God, Colliber insists, since all of space is God and distance between parts of space is only space.[20] The necessity of space is no more in doubt than it was with Samuel Clarke for:

> "Expansion in the larger sense of the word ought not to be reputed (as usual) to be merely accidental to being in general, but that it is to be esteemed the very fundamental notion of all beings (or substance) without which no imaginable properties can be conceived to exist and which may itself be conceived to exist with the absence of any particular property whatever which is certainly the case of expansion or space."[21]

[15] The significance of this date will be explained later.
[16] Colliber, *Impartial Inquiry, etc.* (London, 1718), p. 212.
[17] *Op. cit.*, p. 213.
[18] *Op. cit.*, p. 214.
[19] *Op. cit.*, p. 218.
[20] *Op. cit.*, p. 224.

In conclusion it is worth noting that the influence of Locke again appears[22] since Colliber derives the idea of time from the succession of ideas in the mind.[23]

However, even during these years (1704–1730)[24] there is more difference of opinion on these questions than Samuel Clarke's *Letters to a Gentleman in Gloucestershire* would indicate. William Wollaston (1659–1724) as early as 1722 in *The Religion of Nature Delineated* takes issue with the conclusion that space is real and divine and expresses the belief that:

> ". . . space taken separately from the things which possess and fill it, is but an empty scene or vacuum; and to say that infinite space is God, or that God is infinite space, is to say that He is an infinite vacuum; than which nothing can be more absurd or blasphemous."[25]

Furthermore, duration is nothing that exists in and for itself, since Wollaston maintains that time only serves as a measure of the existence of being and is not an entity in its own right.[26]

Such is the state of opinion by 1730 concerning the nature of space and time and their relation to the nature of God. The opinion of Samuel Clarke together with that of Colliber has met with very little objection or dissent. The conclusions of More and Barrow substantiated by Newton and Locke are both current and accepted. Theology is depending upon the results of science for the formulation and support of its more particular doctrines. But a change is not far off even though this change does not represent a direct repudiation of scientific conclusions. In its immediate concerns the new opinion only attempts a disproof of the presumed alliance between God and space and time. In pursuing this aim it looks no further than to a criticism of the reality of space and time for if these can be proved relational or "mental" then their only claim as God's attributes has been destroyed in so far as this eighteenth century religious philosophy is concerned. Quite obviously, the criticism might have attempted to penetrate more deeply and show that with the denial of real space and real time the foundations of science had in themselves been disturbed. However, the men we are to consider now represent far more completely theological rather than scientific purposes. Also it was quite possible that in their criticisms of space and time some direct results might have been produced for philosophy. But here as well their religious pursuits predominate, so that once more it is necessary to wait until Berkeley for a thorough questioning of the work of Newton and Locke, in so far as this work relates to philosophy and science.

[21] *Op. cit.*, p. 226.
[22] Cf. Locke, *Essay*, Bk. II, ch. 14.
[23] Colliber, *Impartial Inquiry*, p. 228.
[24] Berkeley has been omitted here purposely for later treatment.
[25] Wollaston, *Religion of Nature*, 6th ed. (London, 1738), p. 74.
[26] *Op. cit.*, p. 75.

In 1702 William King (1650–1729) published his *De Origine Mali* which was translated in 1731 by Edmund Law (1703–1787) under the title *An Essay on the Origin of Evil.* To his translation Law added many notes some of which present a theory of space originating in a criticism of Samuel Clarke's *Discourse.* Before considering Law's additions it may be well to say that King was of the opinion that space is to be understood as different from matter for:

> ". . . space is as distinct from matter or body as wax is from the colors necessarily received and does not depend on them any more than wax does on any particular form."[27]

But if you ask what this space may be it is very hard to determine. However, after eliminating various possibilities certain characteristics seem to remain attached to the concept and we may infer that:

> ". . . space (as we conceive it) is something extended, immovable capable of receiving or containing matter, and penetrable by it."[28]

Whether or not this space is something that is real and existent, King is rather unwilling to decide since "philosophers are not agreed."[29] At least we can be certain that we have some "idea" of it.[30] When the question arises as to the necessity of space King is more certain of an answer and suggests that we connect necessity with the existence of space "merely out of prejudice,"[31] because in considering anything other than ourselves this other thing always appears "outside" of us. How can we resolve this question? Let us observe the mind itself or as King suggests, "by a reflex act we view the mind itself and its operations,"[32] then we shall see that:

> ". . . nothing of extension or space offers itself in these, nor does the mind, when employed about them, think at all of space, nor is it conscious that it occupies space."[33]

So King would deny to space the necessity that Samuel Clarke had been at such pains to prove. Furthermore, King can find in space nothing of activity[34] that could possibly lead one to conclude that it had the slightest connexion with God or His attributes.

If the above represents a fair account of King's opinions there appears to be little or no evidence that they met with any consideration before 1731 in which year Law published his translation and added explanatory notes. In the notes referring to the passages on space Law takes the opportunity of introducing his own views on this subject at the expense of Samuel Clarke's *Discourse* which by this time was well known and had been through many editions. Samuel Clarke, however, had died in 1729 so his nephew, John Clarke, undertook, an answer[35] to Law's criticism. In reply to John Clarke, Law added a postscript to the second edition of his translation of King and published both his original translation and notes together with the postscript in 1732. This brought forth from John Clarke a second pamphlet[36] in which he attempts to answer the arguments that Law added in the postscript of the second or 1732 edition of the King translation.

Since there is hardly space for a detailed analysis of the *Notes, Postscript,* and two *Defenses* only a general account of the two positions can be attempted. Law bases his criticism of Clarke on an interpretation of that part of Locke which treats of the origin of ideas of space and time.[37] We derive the idea of space by:

> ". . . observing that all bodies agree in being extended, as well as solid, though they never differ so much in magnitude and figure, we take the former of these properties apart from the latter, as also from any particular magnitude or shape, and call it extension in the abstract; which being thus made general it will comprehend all particular extensions and may be enlarged every way and amplified *in infinitum.* We can conceive it as existing beyond the limits of body, and by adding the confused idea of a substratum to it, it will become independent and serve both as a common measure and a common receptacle for all bodies, which probably constitutes our idea of space. . . ."[38]

The origin of the idea of time is similar as might be expected of one following the same line of approach as Locke.

> "Observing a train of ideas succeeding one another in our minds at certain distances and being conscious that we ourselves exist while we receive them, or that our own existence is commensurate to this succession we get the idea of continuing. Observing also that several other things continue as well as ourselves, we find that the same affection belongs to them; but it being an endless work to form as many distinct ideas of this kind as there are things that thus continue, we abstract from particular existences and make one general idea of continuance, which serves for all, and this is duration."[39]

If space and time are formed in this way we must ask what is the nature of these abstract ideas once they have come before the mind. To such a question as this Law replies that:

> ". . . abstract ideas such as these evidently are . . . exist under that formality no where but in the mind, neither have they any other foundation nor can they be a proof of anything, beside that power which the mind has to form them."[40]

Space, if we attempt to consider it for itself, is a nonentity of which nothing can be affirmed but everything denied. It is an abstract idea formed in the

[27] King, *Essay on the Origin of Evil,* translated by Law, 2nd ed. (London, 1732), p. 9. From this point to the end of the chapter it may be helpful to consult occasionally the outline at the end.
[28] *Op. cit.,* p. 10.
[29] *Op. cit.,* p. 25.
[30] *Op. cit.,* p. 26.
[31] *Op. cit.,* p. 32.
[32] *Op. cit.,* p. 40.
[33] *Op. cit.,* p. 40.
[34] *Op. cit.,* p. 44.

[35] John Clarke, *A Defense of Dr. Clarke's Demonstrations of the Being and Attributes of God* (London, 1732).
[36] John Clarke, *A Second Defense of Dr. Clarke's etc.* (London, no date, but either 1732 or 1733).
[37] Cf. Locke, *Essay,* Bk. II, ch. 13–14.
[38] Law, translation of King, 2nd ed., 1732, note 1, p. 6.
[39] *Op. cit.,* note 1, p. 7.
[40] *Op. cit.,* note 1, p. 7.

mind from a contemplation of that property of matter which is called extension. Extension itself can never be considered as having properties of its own any more than it can be made applicable to God's attributes or be capable of positive infinity.[41]

It is apparent throughout the passages quoted that Law has assumed a nominalistic point of view of these concepts quite in keeping with the text of *De Origini Mali.* The authority of Locke is involved only in so far as this is relevant for the origin of the ideas and Locke's further position, as to the nature of the scientific objects which cause the empirical objects, is not in the least exploited. It is hardly necessary to point out here how widely different from Samuel Clarke is this position of Law. Instead, it is better to turn to John Clarke's defenses of his uncle where we shall find a practical repetition of the views expressed in the *Discourse* and *Letters.* In fact we may well begin with an appeal to the authority of Samuel Clarke which reads:

> "That Dr. Clarke [Samuel Clarke] asserts space to have real qualities is true. But then he does not consider it strictly as a property but as its own substratum; that is, considering these properties, which he applies to space as being truly and really inherent in that which is the substratum of space, as for instance, penetrability, immobility, indiscerptibility, and infinity[42] are strictly properties of the infinite being to whom space belongs. But then they are such properties as could not pertain at all to that infinite being, without space was a property of him also. . . . Space is the extension or expansion of that infinite being. . . . "[43]

The above quotation leaves one quite prepared for the account of time, so that we learn with little surprise that:

> "The same of time as was of space. It is not time or duration that endures but the substratum of duration; for duration is only enduring and what can enduring be without something to endure? For as duration is no substance there must therefore necessarily be some substance to which it belongs. . . . Duration is as I said before, (p. 21) a continual flux which was and always is the same. It is the uniform perpetual flowing of the existence of the Deity. It neither does nor can possibly depend at all upon the succession of ideas in any person's mind whatever."[44]

It may be added that John Clarke asserts the real existence of space because he contends that if space is nothing so also duration. However, it is possible to distinguish time from space and since two nonentities are identical time and space cannot be such. Furthermore, space is more than a mental construct lacking external existence because as Locke maintained it is a simple idea and simple ideas have objective reference. At the same time this view denies that it is relational or is body for our ideas of relations and of body are not simple. And last of all, neither time nor space are substances for since both are equally necessary and infinite both could equally well be called substantial were it not contradictory to have two infinite substances.[45]

[41] *Op. cit.*, note 3, p. 10.
[42] Cf. Henry More, *Enchiridion Metaphysicum*, ch. 8, sec. 8.
[43] John Clarke, *A Defense of Dr. Clarke, etc.* (London, 1732), p. 49.
[44] *Op. cit.*, p. 50.
[45] *Op. cit.*, pp. 61–64.

It is quite easy to imagine that the discussion might have stopped at this point for both contestants have said about all they have to present. Each has been loyal to his own set of traditions, Law presenting the opinions of King under the influence of a certain attitude toward Locke while John Clarke has done little more than repeat the arguments of Samuel Clarke. An end of the matter might well be expected and probably would have occurred but for the entrance of a new figure, Joseph Clarke (d. 1749). Joseph Clarke, of whom very little is known except that he probably resided at Cambridge and is not related to Samuel or John Clarke, published in 1733 a pamphlet[46] in two parts in which he defends Law and answers the two pamphlets of John Clarke. In the same year (1733) John Clarke responds with his last or *Third Defense of Dr. Clarke's Demonstration, etc.,* which is an answer to the two pamphlets of Joseph Clarke published in the same year. This we might call the second stage of the discussion the first being represented by Law and John Clarke while the one under consideration now is between John Clarke and Joseph Clarke. Since John Clarke in his *Third Defense* does not present any new material of importance we may shorten our account to a summary of Joseph Clarke. In the first place, space is devoid of properties, for:

> "We deny then that any property, attribute, etc. is applicable to space. And we think it is equally improper to say, that space has a property of receiving body; as to say that darkness has a property of receiving light, silence the property of receiving sound, etc. Space indeed is a void, in which body may exist; or to speak more properly, where there is space, i.e., no body existing now, there it is possible for body to exist. But that body may exist is not from any positive property that space has, or is indued with, of receiving it; but from nothing being there to hinder it; and from space not being indued with any property whereby it can exclude it from existing."[47]

Not only is space devoid of properties in its own right but it is misleading to speak of space as necessary and then argue from this necessity to its existence for:

> "As to its [space] being presupposed to the existence of everything which is to exist in it, it is sufficient to say, that the presupposition of space does not prove the pre-existence of it. The absence of one body must be pre-supposed to the presence of another body in the same place; but yet the pre-supposition of the absence of one body does not make the absence of one body something really existing."[48]

If space cannot have properties and is not necessary Joseph Clarke is prepared to answer John Clarke when he states that God and space have attributes in common.[49] The answer consists in denying that either God or space have these properties[50] and that such a conclusion makes space an attribute of God[51]

[46] Joseph Clarke, *Dr. Clarke's Notions of Space Examined* (London, 1733). Part I answers John Clarke's 1st *Defense;* Part II, the 2nd *Defense.*
[47] *Op. cit.*, Part I, p. 27.
[48] *Op. cit.*, Part I, p. 36.
[49] See Joseph Clarke's quotation p. 35 and notes.
[50] *Op. cit.*, Part I, p. 47.
[51] *Op. cit.*, Part I, p. 47.

which, in so far as John Clarke is concerned, rather misses the point. In brief then, space and time have no concrete existential relatum to which they may be referred; the same conclusion in fact as expressed by Law.[52]

Once again the discussion of this problem might have ceased at this second stage had not once more a new writer contributed his arguments towards a solution. In 1734 John Jackson (1686–1763) published *The Existence and Unity of God, etc.,* which we may use as a mark to distinguish a third stage. Jackson is interested in defending John Clarke's three pamphlets in defense of Samuel Clarke and in answering Law's notes and postscript as well as Joseph Clarke. In answer to Jackson, Joseph Clarke published in 1734 *A Further Examination of Dr. Clarke's Notions of Space* in which he also answers the third (1733) pamphlet of John Clarke. Furthermore, Law was again drawn into the dispute and published in 1734 his *Inquiry into the Ideas of Space, Time, etc.,* in which he takes up in detail all of Jackson's arguments. As we said before John Clarke's third *Defense* contains no fresh material and the same is true of Joseph Clarke's second *Examination.* For this reason we shall only compare the arguments advanced by Jackson with the answer prepared by Law in his new volume of 1734. In other words, our consideration in this third stage is restricted to Jackson and Law. In this connexion we may best understand their work if we compare their arguments for the discussion has been to some extent codified and in this way serves to bring together in one place the chief arguments of the two sides from the beginning in 1731.

John Jackson[53]	Edmund Law[54]
1. Space and time are simple ideas. Thus, they have objective relatums. Therefore, they are real (pp. 56, 63).	1. Space is not a simple idea for space is essentially *partes extra partes* (pp. 33–38).
2. Ideas of space and time force their existence upon us. Therefore, their existence is positive and necessary (pp. 57, 71).	2. Space and time are not necessary for God. Furthermore, we cannot argue from necessity of ideas to necessity of existence (p. 45).
3. Space and time have real properties. Therefore, they are real (pp. 57, 77–81).	3. The dimensions of space are "ideal" not "real" (p. 49).
4. Space and time are infinite. No ideas are infinite. Therefore, space and time are not ideas but real attributes (pp. 57, 83, 86).	4. The reality of space and time must be proved before we can discuss their infinity (pp. 54, 58).
5. Space is necessary for motion (pp. 57, 89).	5. The idea of space and the idea of motion are not necessarily connected (p. 66).

[52] *Op. cit.*, Part I, pp. 83–85. Cf. Joseph Clarke's quotation p. 33 and also Law, translation of King, 2nd ed. 1732, note 3, p. 10.

[53] *The Existence and Unity of God, etc.* (London, 1734).

[54] *An Inquiry into the Ideas of Space, Time, etc.* (London, 1734). Page numbers at the end of the arguments refer to the respective volumes.

6. If the space between the two sides of a room is nothing, the two sides would not remain separated (pp. 57, 79, 92).	6. Space is but the absence of body so the difficulty is paradoxical (p. 76).
7. If space is nothing, then if God moved the whole world in a straight line it would always be in the same place (pp. 57, 93).	7. In natural philosophy the distinction between relative and absolute motion is legitimate. In metaphysics there is only relative motion (pp. 69–74).
8. If time is nothing, there are no differences in ages, e.g., a child is as old as Methusalah (pp. 58, 95).	8. Argument similar to the preceding (p. 84).
9. If time is nothing, then even if God created the world sooner than he did it would be no older (pp. 58, 95).	9. Criticism of the meaning of "sooner." The idea of time is a relative idea (pp. 86–88).

There is little more to add for after the above interchange of opinion the contestants appear to have exhausted completely their store of speculations on space and time. It is worth noting, if only for the sake of completeness, that there are two other contributions to the discussion outlined since 1731. In 1733 Isaac Watts (1674–1748) best known as a writer of hymns, published a volume of *Essays.*[55] The first essay of this collection serves to classify Watts as sympathetic to the cause of Law and Joseph Clarke. Although he presents his case with as much acumen as any of his colleagues or opponents he does not succeed in throwing any new light on the subject. He has been omitted from the above account only because his work did not enter directly into the treatises we have been considering, that is to say, his *Essay* was not written as an answer to previous pamphlets nor was his *Essay* answered in subsequent pamphlets. The second addition to this literature is the correspondence between Jackson and William Dudgeon (fl. 1737–1765). This consists of twenty-four letters written between 1735 and 1737, and published in 1737.[56] They represent dissent on the part of Dudgeon to the views Jackson expressed in his *Existence and Unity of God, etc.,* and although there are some passages relevant to space and time the questions and arguments do not differ from those recounted previously.

So far as can be ascertained this brings the theological implications of space and time to a close. As pointed out above, the pamphlets written on the two sides stick rather closely to their particular point and do not investigate the problems set for them either by Newton or Locke, at least in their larger implications. Quite clearly, the difficulty arises from the interpretation that Samuel Clarke gave to his reading of Newton and the advantages he saw in the Newtonian science for theology. How it was possible for Samuel Clarke to find this material in Newton and how it came to be in Newton it is hoped has been made clear. It seems manifest that Samuel Clarke and his followers were of

[55] Isaac Watts, *Philosophical Essays on Various Subjects* (London, 1733). Essay I, *A fair inquiry and debate concerning space, whether it be something or nothing, God or a creature.*

[56] William Dudgeon, *Several Letters to the Rev. Mr. Jackson . . . with Mr. Jackson's answers . . .* (London, 1737).

the opinion, that given the opportunity it was to the advantage of theology to employ in so far as it could the results of the new science. It is just here that a larger question arose, a question that might be formulated as to what extent it was expedient and necessary for religious philosophy to take into account natural philosophy. In this question we find the setting for the smaller question which it has been the purpose of this chapter to consider. The immediate difficulty is the discussion over the nature of space and time as they may or may not be related to God and His attributes. This we may say provided the materials of the argument. But the argument has a larger setting in that the basis for disagreement about theories of space and time is furnished by the more embracing question of the relation between contemporary religious and scientific standards and results. Here, rather clearly, King and his supporters represent a more conservative opinion than Samuel Clarke. Religious problems are in a class unto themselves and in the attempt to connect religion and science religion has much to lose. The nature of this loss is never too clearly stated but there seems to be the intention to regard the being of God and His attributes as not open to the rationally deduced knowledge which Samuel Clarke's *Discourse* endeavors to state. It is misleading and confusing to find in space and time evidences of God since God's nature is necessarily unknown. The effort to deduce space and time as God's attributes misses the real understanding of God and places God in a context which is unworthy of His nature. Such an attitude as this seems fairly evident in King[97] and contrasts sharply with the rationalistic temper of Samuel Clarke's work. Of the followers of these two men, e.g., Jackson, John Clarke, Law, and Joseph Clarke, it is not so easy to draw the same conclusion. Their efforts are concentrated on proving a point and the writings we have mentioned bear too firmly the marks of controversy to have much room for other impressions. That it is possible they would fit into the interpretation offered has, however, a somewhat greater probability than any other.

Of next importance for these authors is Locke, and it is interesting to note that as the discussion grows, Locke is appealed to more and more by both sides. That Locke could be of authoritative interest to both factions is surprising only if the *Essay* is forgotten. Within its covers can be found both a relative and an absolute theory of space and time, and what is more a formal if not a real offer of a choice to be made by the reader. These theologians made their own selection and a selection which was secondary though important to the conclusions they wished to reach. Of the more abstruse problems of a theory of knowledge they fail to take notice nor do they find Locke relevant to a solution of the connexion of the scientific categories to religion.

In spite of their many failings both in essential grasp of the problem they were attempting to solve and in the quality of thought they bring to bear on that problem they may claim notice not only as a fairly unique historical phenomenon but also as yet another approach, logical and not temporal, to the work of Bishop Berkeley.

[97] King, *Sermon on Predestination* in King's *Sermons* edited by Whately (London, 1821), pp. 8, 19, 21.

Summary

A. Edmund Law and John Clarke.
   1. Law: I Notes, 1731.
      a. Criticizes Samuel Clarke: Discourse, 1705.
   2. John Clarke: I Defense, 1732.
      a. Answers Law: I Notes, 1731.
   3. Law: II Notes, 1732.
      : Postscript, 1732.
      a. Answers John Clarke: I Defense, 1732.
   4. John Clarke: II Defense, 1732–33.
      a. Answers Law: II Notes, 1732.
      : Postscript, 1732.

B. Joseph Clarke and John Clarke.
   1. Jos. Clarke: I Examination, 1733.
      a. Part I answers John Clarke: I Defense, 1732.
      b. Part II answers John Clarke: II Defense, 1732–33.
      c. Defends Edmund Law: I Notes, 1731.
      : II Notes, 1732.
      : Postscript, 1732.
   2. John Clarke: III Defense, 1732.
      a. Answers Jos. Clarke: I Examination, 1733.
   3. Jos. Clarke: II Examination, 1734.
      a. Answers John Clarke: III Defense, 1733.
      b. Criticizes Jackson: Existence and Unity, 1734.

C. John Jackson and Edmund Law.
   1. Jackson: Existence and Unity, 1734.
      a. Criticizes Law: I Notes, 1731.
      : II Notes, 1732.
      : Postscript, 1732.
      b. Criticizes Jos. Clarke: I Examination, 1733.
      c. Defends John Clarke: I Defense, 1732.
      : II Defense, 1732–33.
      : III Defense, 1733.
   2. Law: Inquiry, 1734.
      a. Answers Jackson: Existence and Unity, 1734.

D. Isaac Watts.
   1. Watts: Essay, 1733.
      a. Defends Law and Jos. Clarke.
      b. Criticizes Samuel Clarke and John Clarke.

E. William Dudgeon.
   1. Dudgeon: Correspondence with Jackson, 1737.
      a. Criticizes Jackson: Existence and Unity, 1734.

CHAPTER VII

GEORGE BERKELEY

It is probably true that the best introduction to a study of the works[1] of George Berkeley (1685–1753) is through the *Commonplace Book*,[2] although this is dangerously close to saying that Berkeley's writings are in themselves their best commentary. At all events the *Commonplace Book* does suggest, in miniature if not on a larger scale, nearly all that Berkeley had to say although the detailed explanation of his theories was divided over a rather long philosophical career. But there is more to these few pages than a hint of what is still to be written, indeed quite often a hint that is only important because later the particular points were developed, for it is here that we see most clearly, the relation of Berkeley to Newton and Locke. Even in this respect some qualification is necessary for it is not to be supposed that the *Commonplace Book* alone shows a connexion between Berkeley and his famous predecessors. Quite obviously, many of the writings that followed its composition show the contrast between the earlier thinkers and the later. But in his earliest attempts at speculation Berkeley so exemplifies his relation to Newton and Locke as to suggest that it was a knowledge of what these men believed that led Berkeley not only to originate his own particular type of thought but to develop this thought as he did. It is here assumed that Locke and Newton exerted an equal influence on the thought of the younger man. It is not particularly advantageous to decide at this point whether Berkeley is to be interpreted as developing exclusively either Locke's epistemological problem or Newton's cosmological conclusions. There is sufficient material to enlarge either opinion in detail although it is hardly possible to validate one of them except through neglect of the other. It should be remembered that in Berkeley's work there are other strains of influence than Locke and Newton. To some extent these will be purposely omitted for two reasons. First, they are not necessary for an understanding of Berkeley in general or for a comprehension of what Berkeley was attempting to do with space and time. Secondly, they would be considered more properly in a study that was not confined to the English speculations of this period.

We may take the *Essay* and the *Principia* as representing in Britain, at the beginning of the eighteenth century the two great canons for philosophy and science, and the *Essay* as a major source of opinion regarding the relation of science to knowledge. It is to be expected, that at this time, any intelligent person with an interest in the questions of philosophy and science would naturally turn to the two works which were both famous and respected. It is equally easy to fancy that such a person might possess sufficient independence and intellectual force to question closely the results and answers set forth in these

[1] All references are to Fraser's edition of Berkeley's *Works* (Oxford, 1901), 4 vols. by volume and page except where noted.
[2] I. 7–92.

volumes. We have realized in Berkeley such a person, while in his *Commonplace Book* we have preserved his first recorded reactions to the two most characteristic influences of his day. In these comments[3] composed and set down more or less at random from 1705–1708 there is implied, as we mentioned above, a criticism of Locke and Newton which promises rather surprising results. If we restrict our reading to those passages referring to space and time this will provide a fairly satisfactory point of departure for a general sketch of Berkeley's theory of knowledge and metaphysics, after which we may return to those works in which the material appears in greater abundance for our particular research. It will then be necessary to show how this material is related to Berkeley's system and the work of the other men who have been considered previously.

The first pages[4] of the *Commonplace Book* provide us with two very definite points of view. First, there is an examination of what is meant by time and space. Secondly, from this examination there arises the very essence of Berkeley's theory of knowledge and the metaphysics on which this is based. Following Berkeley's order of discussion we notice first that:

> "Time is the train of ideas succeeding each other."
> "Duration not distinguished from existence."[5]

Considering these two statements together, for the second one is printed immediately under the first, we seem to find Berkeley intending that the existence of ideas is dependent upon, in the sense that it is indistinguishable from, their duration. Duration affords us a measure of the existence of things. Returning now to the first statement for a meaning of duration we learn that it is identified with the "train of ideas." Our train of ideas affords us a measure of existence which answers the question "how long?" It is apparent that here is a greater degree of relativism than was apparent in Locke or Newton. Nor are we to doubt that Berkeley realized the implications for at once it is stated:

> "Why time in pain longer than time in pleasure?"[6]
> "The same τὸ νῦν not common to all intelligences."[7]

Time is relative to the individual and it is not possible to discover some objective time or even some objective measure of time. Consequently,

> "Time a sensation; therefore only in ye mind."[8]

The same is true of extension for without previous notice Berkeley adds:

> "Extension a sensation, therefore not without the mind."[9]

[3] In reading the *Commonplace Book* I have followed the order suggested by Johnson, *The Development of Berkeley's Philosophy* (London, 1923), note to p. 20.
[4] I. 58–60.
[5] I. 58.
[6] I. 58.
[7] I. 59.
[8] I. 59.
[9] I. 59.

At this point the entries change from their consideration of space and time to an account of matter:

> "Primary ideas prov'd not to exist in matter, after the same manner y^t^ secondary ones are prov'd not to exist therein."[10]

We find in this short sentence a complete summation of Berkeley's criticism of Locke's theory of knowledge. It should be pointed out, however, that Locke never said anything of this kind. The sentence, nevertheless, is of great importance in revealing Berkeley's reaction to Locke for in this comment we see Berkeley reading Locke's "ideas of primary qualities" into matter and then calling them "primary ideas." When considered with the sentence but three lines below we experience a foretaste of the kind of philosophy we may expect to follow if these opinions are developed, for:

> "World without thought is *nec quid, nec quantum, nec quale,* etc."[11]

The remainder of the *Commonplace Book* is devoted to a careful testing of these preliminary conclusions in contrast to what Berkeley understood Locke and Newton to mean. For one with philosophical interests it is probably not too rash to suggest that the passages in the *Principia* referring to time and space are most obviously attractive. As we have seen Berkeley starts with these and the question that arises in these notes is the validity of absolutes. But no sooner has this occurred than the interest shifts quite naturally to a more direct examination of Locke and indeed that part of Locke's doctrines which has the most immediate reference to Newton's absolutes or the system of scientific objects. Again the principle of relativism is applied to primary qualities in the same way it was utilized on absolute space and time and with the same conclusion for the ideas of primary qualities are put in the same class with the ideas of secondary qualities. As members of this class their major characteristic is that they are known and are contingent upon mind in the sense that their existence is dependent upon and meaningful only in so far as they are relative to intellect. Without thought the world has neither quantity nor quality; it is as nothing at all.

If now, for the purpose of explaining Berkeley's theory of knowledge, we regard that theory as in some measure a logical development of Locke's *Essay* we may simplify the exposition according to the scheme employed in Chapter V. There it was maintained that in any act of knowledge three entities were involved—mind, empirical objects, and scientific objects. It may be recalled that empirical objects were of two kinds—ideas of primary qualities and ideas of secondary qualities. Let us set now as one question the connexion that Berkeley's theory of knowledge bears to this classification. First of all there is mind. As in Locke, so in Berkeley this is a term that does not require examination since it is possible to regard Berkeley's epistemological problem as distinct at this point from whatever theory of mind he may have held. In the second place there are ideas. Let us postpone their examination until we have seen what opinion Berkeley held as to the nature of scientific objects, for quite

[10] I. 59.
[11] I. 59.

obviously it will be in discourse about the objects of science that the theory of ideas can be explained most easily.

It is here that Newtonian science with its emphasis on mathematically described masses enters most crucially into this problem of epistemology. We have seen in Locke that it is this class of absolute masses treated mathematically that is postulated as the cause of empirical objects and that in so far as we have ideas of primary qualities we have ideas of properties inhering in these absolutes, while when we have ideas of secondary qualities they are ideas of qualities caused for the mind by the relation that the mind bears to these same absolutes. The question proposed by Berkeley appears to be how can we have knowledge of these scientific objects if it is admitted that the only knowledge possible is a knowledge of ideas? We are never in a position to compare our ideas, the only things ever before the mind, with the terms to which they are supposed to relate, for it is insisted that these terms never can be before the mind. Have we not here a class of objects which by definition we never can know and are we not using this class of objects as the essential explanation of how it is possible to have ideas or something that we can know? On what basis does Locke separate ideas as primary and secondary? In what way can we say that an idea of blue is different from an idea of extension? Never are we in such a relation to scientific objects, the mind having nothing but ideas, to compare or make certain the correspondence between ideas and anything else. The only possible comparison that we can make is that of one idea with some other idea. However, it has been asserted that the objects of science exist in their own right as a class utterly distinct from the class of objects that confront the mind.

If it is correct to assume that this is Berkeley's reaction to Locke's scheme it is not surprising that there should follow a drastic criticism of Newton's scientific objects. To omit this class of objects from consideration, since they can never be known, and confine our attention to ideas or that about which we can have intelligible discourse, is the conclusion Berkeley proposes when asked to consider the validity of a world of matter as necessary for explaining knowledge. For our purposes we can omit the particular criticisms that Berkeley directs toward the concept of matter as well as his criticism of the mathematical theories current at this time and important for describing the system of scientific objects.

If the assumed "objects of science" have been denied there remain but two factors to be described—minds and ideas. Starting with ideas, we discover that simplification has been insisted on with the result that ideas may no longer be considered as dual in the sense of primary or secondary. All ideas are to be regarded under the aspect of Locke's ideas of secondary qualities but with at least one important qualification. No longer is there a world of scientific objects which through their relation to mind cause ideas for mind; ideas are not to be thought of as effects of scientific objects when scientific objects are related to mind. Ideas are things that are in relation to mind without reference to anything else.[12] They are unique, different from mind, yet the only thing that mind is ever aware of or related to. There is no difference between ideas in the fashion that Locke intended for no idea can have reference to the

[12] The relation of ideas to God has been purposely omitted here.

Newtonian class of scientific objects. This is not to insist that there is no difference in ideas in the sense that an idea of blue is other than an idea of red but only to conclude that one idea is just as "real" as any other idea.

By generalizing this attitude and changing the terminology we arrive at the formula that "*esse* is *percipi*." Although the possible meanings of this proposition are as numerous at least as the analytical powers of G. E. Moore has revealed, we may perhaps restrict ourselves to a less detailed account without doing violence to Berkeley's intentions. From his point of view it seems important to remember that ideas constitute the only imaginable reality so that the extent of being in so far as mind is concerned is exhausted by the perceptions that are possible to mind. Furthermore, this proposition is of great importance for Berkeley's treatment of space and time in that our knowledge of space and time depends solely on and is limited to a perception of space and a perception of time. In contrast to such a position is the one stated in the proposition that "*esse* is *intelligi*." Such a proposition as this does not yet appear in Berkeley's theory. The existence of an object for knowledge depends upon perception and neither upon the conceptive powers of intellect, intellect as yet has not been introduced into Berkeley's system, nor upon the intelligibility of a possible object. For this reason it is helpful to regard Berkeley's theory of knowledge as a relativisitc monistic epistemology, rather than as is more customary to say a subjectivistic one, in contrast to the relational dualistic epistemology of Locke. By this distinction it is hoped that a rather important emphasis may be made clear, i.e., the ideas in Locke's system refer to an external world which is a system of material objects and in this sense there seems justification for the term "relational." In Berkeley, however, ideas have no relation to an external world of matter so that knowledge is not relational but relativistic since ideas are always at least as unique as the minds that they confront and by definition have no possible meaning apart from the minds they do confront. It is still possible to speak in both theories of knowledge of the relation of ideas to mind and regard this as in some sense pointing to a second dualism. However, it should be remembered that this usage of dualism is a very different one from the former and raises a problem not realized by either Locke or Berkeley, yet is a problem that both have in common and to which both react alike.

Knowledge is relativistic but before starting an examination of Berkeley's theories of space and time from this point of view there remains the necessity of a short account of the part that God occupies in this system. It has long been customary to ascribe most, if not all, of Berkeley's difficulties to a desire to find for God a necessary and important place in his philosophy or if this attitude has not been assumed it has been insisted that somehow or other Berkeley introduces God at the end of his system because not being content to be only a philosopher he wishes to become a Bishop. Such attitudes quite miss the point and indeed the flavor of seventeenth and eighteenth century speculation. In this period it is hard if not impossible to find examples in philosophy or science where God does not possess a rather important field of activity. To make this clear it is necessary to recall only Locke and Newton and possibly the leading figures of Chapter VI. Let us give to Berkeley the

meager justice that his philosophy would have been what it is even had he not been Bishop of Cloyne although there is no reason to think that as Bishop he found this philosophy inadequate to the position.

If all our knowledge consists of ideas, what is the connexion of these ideas to God? Analogously to the ideas before our minds there are ideas before the mind of God. The ideas before God's mind are very different from the ideas constituting our field of knowledge, yet there is a relation subsisting between these two classes, a relation that recalls the relation subsisting between Locke's ideas of primary qualities and those qualities as they inhere in Newtonian scientific objects. At this point (1734) we may consider Berkeley as introducing "intellect" and "notions" in contrast to mind and ideas, into his theory of knowledge. With the addition of these new terms important changes are made in the extent of man's knowledge. It is now possible to broaden the proposition that "*esse* is *percipi*" to the other proposition that "*esse* is *intelligi*." With these two propositions Berkeley's epistemology and metaphysics is complete. From perception we have ideas, from conception we have notions. The first class includes the subject matter discussed above and in particular time and space. But within the second class is our knowledge and understanding, in a small and imperfect way, of those ideas which are before the mind of God. The world for Berkeley is primarily relativistic to God and secondarily relativistic to human minds. The connexion between the two arises from the relation that our ideas bear to God's ideas. Exactly what Berkeley means by this is an important problem and we must defer an exposition of this until later. In this treatment, there is suggested a semblance of the Lockian dualism under a new aspect although God's ideas are not unknowable for us as was Locke's system of scientific objects. God's ideas are the limits to which human understanding aspires. From this schematic outline of Berkeley's epistemological problem let us direct our attention upon his more particular theory of space and time in its relations to this epistemology and the theories of his predecessors.

In the opening pages of this chapter we have considered the few remarks on space and time that appeared in the *Commonplace Book* and it is probably not necessary to examine these any further since they are included in much that was written later. For this reason it seems best to consider first the *Essay on Vision* and then *The Principles of Human Knowledge*. The *Essay on Vision* was first published in 1709 and in its point of departure and method we find a close adherence to the attitude we have examined in the *Commonplace Book*. At the start Berkeley examines the current theory of "seeing by geometry" and according to the method explained in the *Commonplace Book* decides that this theory is unsatisfactory because it explains vision without taking into account what is present in vision. In seeing we have no perception of angles, so it is impossible to state that we see by angles. We have a perception of distance when we see and not a perception of angles.[13] However, distance in itself is invisible,[14] so that some other idea must be postulated as the means for our perception of distance,[15] yet this must be of such a kind that it is

[13] I. 130.
[14] I. 127.
[15] I. 130.

directly perceived and not inferred as are the angles in the geometrical theory. In the first place, we have a perception of motion of the eyes,[16] secondly, a perception of distinctness in the object seen depending on its distance from us,[17] and thirdly, a perception of eye strain.[18] From these certain and immediate perceptions we are able to perceive distance. It is true that the ideas acquired from seeing will be different from those acquired through touch, so by Berkeley's principle of relativity the thing seen is different from the thing touched since there are two distinct ideas before the mind.[19] The importance of this conclusion for Berkeley's theory of space is very great for it enables him to maintain that the mind is not aware of one numerically identical extension but of as many extensions as there are means to acquire perceptions of that which is extended.[20] It is not possible for us to be aware of space if by space we mean something of which we have a clear and distinct idea. The only space that can have meaning is the space which we perceive or that space which we perceive as distance.

The importance of these conclusions as they relate to Berkeley's epistemology and theory of science does not become apparent until we see his system developed more completely in the *Principles* and *Essay Concerning Motion.* The *Principles* were first published in 1710, so that they appeared at a time when Locke's *Essay* (1690) and Newton's *Principia* (1697) were both very well known and established in the prevailing currents of thought of the early eighteenth century. It is both interesting and important to notice that in those sections[21] of the *Principles* which most seriously discuss space and time the point of departure is found in Newton's *Principia,* where in the first scholium he distinguishes between absolute and relative, space, time, and motion.

To begin his account Berkeley repeats the Newtonian distinction:

> "In the entrance of which justly admired treatise [Principia] Time, Space, and Motion are distinguished into *absolute* and *relative, true* and *apparent, mathematical* and *vulgar,* which distinction, as it is at large explained by the author, does suppose those quantities to have an existence without the mind."[22]

Here, as might be expected from the *Commonplace Book,* is the theory that is false and also the theory that Berkeley is certain he can correct in accordance with his principle of relativity. The investigation of space and time for Berkeley will be an attempt to show the relativity of space and time to mind and at the start their relativity to human minds. It is important to notice in this passage that Berkeley has somewhat misread Newton. Relative space and time, as we have seen, are the measures of absolute space and time and even for Newton these measurements would not have "existence without the mind." Quite obviously, Berkeley is correct in assuming that Newton did give absolute

[16] I. 131.
[17] I. 133.
[18] I. 134.
[19] I. 150.
[20] I. 186.
[21] I. 318–324.
[22] I. 319.

existence to absolute space, time, and motion. However, in the passage quoted the antecedent of "those quantities" is indeterminate.

Concerning time Berkeley has treated of the subject to his own satisfaction in an earlier passage of the *Principles* and to this he refers the reader. When we examine these passages we find that for Berkeley the difficulty is part of a very favorite objection which has been applied to many Newtonian and Lockian opinions, i.e., the unintelligibility of abstract ideas. Just as long as we adopt a "common sense" attitude toward time we have no trouble for:

> "Bid your servant meet you at such a *time,* in such a *place,* and he shall never stay to deliberate on the meaning of those words."[23]

Such a situation meets all the requirements of the concrete and particular and the meaning of the words involved, i.e., "time" and "place" arouse no problems for solution or for interpretation. But unhappily, or at least so Berkeley thinks, mankind has not been content to leave the question here. There has been an attempt to consider time in and for itself and from this attempt untold trouble has arisen. The nature of this attempt consists in trying to think of time apart from perceptions of time, for:

> ". . . if *time* be taken exclusive of all those particular actions and ideas that diversify the day, merely for the continuation of existence or duration in abstract, then it will perhaps gravel even a philosopher to comprehend it."[24]

At once a very serious problem is faced for there is in question here the efficacy of the mind in dealing with the question of time. At least two possibilities are open for examinaton. In the first place, time may be of such a character that in essence it is either unknowable or only partly to be understood. Such an attitude would not question the meaningfulness of the question nor would it maintain that the question was necessarily permanently unanswerable until it had been so proved. This conclusion might be held because of a belief either in the adequacy of the mind in general to solve all problems proposed by the mind or because it was felt that as yet sufficient data had not been collected by means of which an answer could be ascertained. The other possibility is very different and is favored by Berkeley. The difficulty occurs because to ask what time is and mean by this time as a self-existent entity is to ask an illogical question in the sense that it takes for granted the existence of an entity when the whole problem depends upon the ascertainment of whether or not that entity exists. If Berkeley can show that time is not a self-existent thing but is contingent and relative to mind then he will maintain that the difficulties of mind arise from a misconception of the problem the mind is considering. When we remember that the entire drift of Berkeley's theory of knowledge is toward a limitation of knowledge to images his intentions become clear. Unless we can have an image of time there is no possibility of discussion about time. The discourse that follows is both characteristic and in harmony with Berkeley's theory of knowledge for:

[23] I. 311.
[24] I. 311.

". . . whenever I attempt to frame a simple idea of *time*, abstracted from the succession of ideas in my mind, which flows uniformly, and is participated by all beings, I am lost and entangled in inextricable difficulties. . . . Time therefore being nothing, abstracted from the succession of ideas in our minds, it follows that the duration of any finite spirit must be estimated by the number of ideas or actions succeeding each other in that same spirit or mind."[25]

Time is nothing but the flux of ideas before the mind. Our perception of time, and there is no meaning to any other statement, is *ipso facto* relative for time must always be understood as time perceived and the relation of our perceptions to each other is the only measure that we can ever bring to use. In this way the absolute time of Newton and Locke as well as the absolute particles comprising the realm of scientific objects which are postulated by Newton and Locke as existing in absolute time are removed by Berkeley from our field of knowledge. We must now see what is the particular result for space when it is subjected to the potent nominalism of Berkeley's system which employs more ruthlessly than ever before the principle of parsimony.

To Berkeley only relative motion seems possible because of the following argument:

". . . to conceive motion there must be conceived at least two bodies; whereof the distance or position in regard to each other is varied. Hence, if there was only one body in being it could not possibly be moved. This seems evident, in that the idea I have of motion doth necessarily include relation."[26]

It is manifest from this that our perception of motion can only arise through a perception of the relation between two bodies when the distance between these bodies is changing. If there were present to the mind a perception of one body and nothing more there would then be no perceived relation. Motion, as perceived, and by the tenets of Berkeley's epistemology there can be no other motion, is dependent upon the perceived relation that ideas bear to one another. Motion must be relative to the mind which perceives the relative distance between bodies. Absolute motion has no meaning for of this we can have no perception, since by definition there are no bodies related.

From the above it is easy to predict the treatment of space. If we deny the existence of absolute motion we have denied one of the arguments for the existence of absolute space since absolute space had been regarded as a necessary place for those motions which were absolute. But as Berkeley points out:

". . . it follows that the philosophic consideration of motion doth not imply the being of an *absolute space* distinct from that which is perceived by sense, and related to bodies, which that it can not exist without the mind is clear upon the same principles that demonstrate the like of all other objects of sense."[27]

In the second part of this passage there is stated the other argument against the existence of absolute space which is immediately followed by the statement that:

[25] I. 311–312.
[26] I. 320.
[27] I. 322.

". . . if we inquire narrowly we shall find we can not even frame an idea of *pure space exclusive of all body.* This I must confess seems impossible, as being a most abstract idea . . . it is not to be supposed that the word *space* stands for an idea distinct from, or conceivable without body and motion. Though indeed we are apt to think every noun substantive stands for a distinct idea that may be separated from all others; which hath occasioned infinite mistakes. When, therefore, supposing all the world to be annihilated besides my own body, I say there still remains *pure space;* thereby nothing else is meant but only that I conceive it possible for the limbs of my body to be moved on all sides without the least resistance: but if that too were annihilated then there could be no motion, and consequently no space."[28]

Space as well as time and motion are denied absolute existence. By space we can mean nothing other than perceived distance and in so far as we have a perception of space this perception is contingent upon the presence of bodies. Whenever we have a perception of space it is always space as measured and in this way is relative to our perception of bodies. At the same time because of this relation of our ideas to one another space is relative to human minds and likewise as in Berkeley's treatment of time is only to have meaning in so far as the perception of it is related to mind.

Before considering our next important source for Berkeley's speculations on these subjects, *The Essay Concerning Motion,* let us notice quite briefly a passage in the *Principles* that refers to the subject matter of Chapter VI; the relation of time and space to God. From the passages quoted above we are prepared to learn that it is quite mistaken to hold that:

"Real Space is God, or else that there is something beside God which is eternal, uncreated, infinite, indivisible, immutable. Both which may justly be thought pernicious and absurd notions. It is certain that not a few divines, as well as philosophers of great note, have, from the difficulty they found in conceiving either limits or annihilation of space, concluded it must be *divine.* And some of late have set themselves particularly to show that the incommunicable attributes of God agree to it. Which doctrine, how unworthy soever it may seem of the Divine Nature, yet I must confess I do not see how we can get clear of it, so long as we adhere to the received opinions."[29]

The Essay Concerning Motion was written in 1720 and published the next year.[30] It provides the reader with the most detailed account that Berkeley has left us of his investigations into the nature of space and time. Although it is not among his most paradoxical papers, it is probably the most important and interesting for his theory of science. There is an insistence that science can deal with nothing but the relative and the perceived. Of the phenomenal we are aware but we are not able to postulate any system of absolutes to which our perceptions have reference. All we can know are our perceptions and these perceptions afford no more than an account of phenomena. To postulate a ground or cause for phenomena violates the self-imposed restrictions of science in that science through its use of perceptions, and it can use nothing else,

[28] I. 322–323.
[29] I. 323–324.
[30] I. 489.

cannot penetrate beyond what is perceived. Science is an account of our perceptions and from their nature only the perceived and the relative can be described.

Consequently, in this *Essay*,[21] Berkeley begins his attack on absolute space by asking the reader to:

> ". . . imagine all bodies to be destroyed and annihilated."[22]

After this has been done he identifies what has been left as absolute space in which there are neither bodies nor relations but which has properties such as infinity, immovableness, indivisibility, etc. But has such space the possibility of being perceived? Quite obviously Berkeley denies that it can and rests his denial on a psychological analysis, for the question is raised as to:

> ". . . what sort of extension is that, which can be neither divided nor measured, no part of which we can either perceive by our senses, or figure in the imagination? For nothing can enter the imagination which from the nature of the thing is not possible to be perceived by sensation. Since imagination is nothing else than a faculty representing the objects of sensation . . . it also evades pure intellect, since that faculty is only conversant about spiritual and unextended things, such as our minds, their habits, passions, virtues, and such things. Let us, then take away mere words from absolute space, and nothing remains in sensation, imagination, or intellect; nothing therefore is denoted by them but mere privation or negation, that is, mere nothing."[23]

The argument closely parallels the treatment in the *Principles of Knowledge* for the denial of space as absolute grows out of the fact that never can the mind have a perception or image of such space no matter which of the mental faculties is considered. In the attempt to imagine all destroyed we forget that we do not imagine our own bodies removed with the rest of matter, so that:

> ". . . if we consider the matter more attentively, it is clear, 1st, that we conceive relative space marked out by the parts of our body, 2nd, a free power of moving our limbs, checked by nothing, and nothing beside this."[24]

In this place another argument is developed, the beginnings of which appeared at the end of the account in the *Principles*.[25] If we continue to regard space as absolute and a thing existing in its own right we are precipitated into a most unpleasant dilemma concerning the nature of God. In the first place, there are many who are so:

> ". . . far from considering absolute space as a non-entity, that they think it the only thing, except God, which cannot be annihilated, and maintain that it necessarily exists by its own nature, and is eternal and uncreated, and consequently participates in the divine attributes."[26]

[21] All references are by section to the translation of *De Motu* edited by Sampson in Vol. II of the Bohn Library edition of Berkeley's *Works* (London, 1898).
[22] Sec. 53.
[23] Sec. 53.
[24] Sec. 55.
[25] I. 323.
[26] Sec. 54.

However, if this be done the conclusion arises that we have identified as a divine attribute something of which we can have no perception and which for us cannot be said to have existence so that:

> ". . . it will be clear to anyone attentively considering, that whatever is predicted of pure space may be predicted of nothing. By which means the human mind is easily freed from great difficulties; and at the same time, of attributing necessary existence to any being except the almighty and all-good God alone."[27]

Berkeley's account of space and time have been remarkably consistent to his principles of relativity up to this point. The same seems to be true of his theory of knowledge and it is probable that just because he has applied so accurately his epistemological conclusions to his investigation of space and time the account within itself seems to be unusually free of defects. But as we mentioned before Berkeley finds in his philosophy an important place for God; a characteristic which he has in common with the greatest of his predecessors. There are ascribed to God, in *Siris*, ideas which are before God's mind in a fashion analogous to the ideas before human minds. The ideas contemplated by God are no more like the ideas known by man than the mind of man is like the mind of God. But even though the human mind is so very different from the divine mind there may be imagined sufficient similarity to speak with propriety of the human mind as differing in degree, although this degree approaches infinity, from God's mind rather than regard them as utterly different in kind. If this be true, the same comparison may be carried over to man's ideas and God's ideas.

Of space and time we have seen that man can only speak of his own perceptions of these. Our perceptions are particular and relative to us, they are private and distinct from the perceptions of space and time as enjoyed by any other mind. Each human mind has its own perception of time and space and there are no other spaces or times to which a mind may refer or of which it may have knowledge. Omitting the question of other human minds and the connexion that might subsist between the space and time of A. and the space and time of B. since this problem is included in a larger one, let us consider what ideas of space and what ideas of time confront the mind of God. By examining this question we can examine what relation may subsist between the divine ideas of space and time and the human perceptions of space and time, since we may suspect some connexion from the analogous treatment of God's mind and ideas to human minds and ideas since there is a tendency to regard all minds and their functions as classes included within the larger class of spirit, i.e., the previously considered attitude of a difference in degree rather than in kind.

Throughout Berkeley's works we get a number of suggestions of the kinds of ideas God might have and what the existence of these ideas mean for the ideas present to man, but it is primarily in *Siris*[28] that the problem finds its most distinctive treatment. The development is Platonic for in the discourse about God's Ideas we discover that they are archetypes or immutable and eternal forms which, in contrast to human images, are notions, in contrast to the percep-

[27] Sec. 56. For further similar material on this point see Letter to Johnson, March 24, 1730, in Fraser II. 19.
[28] First published 1744. In *Siris* God's Ideas have a capital "I."

tible are intelligible. Now the proposition that *"esse* is *intelligi"* finds an important place in Berkeley's system, since God's Ideas are intelligible for human minds, can be conceived but not perceived. For example we learn that:

> "The most refined human intellect, exerted to its utmost reach, can only seize some imperfect glimpses of the Divine Ideas, abstracted from all things corporeal, sensible, and imaginable."[39]

And again speaking of the Divine Ideas they are:

> "The most real beings, intellectual and unchangeable; and therefore more real than the fleeting, transient objects of sense which, wanting stability, can not be subjects of science, much less of intellectual knowledge."[40]

In these passages we see developing important conclusions for a theory of science such as that sketched in *The Essay Concerning Motion.* There the emphasis was on the phenomenal and the relative and the attack on absolutes was particularly vigorous yet this is not to say that such a position has been changed in *Siris.* Only now, some account is offered of a system which is intelligible though non-perceptual. This system which is to lend order and arrangement to phenomena cannot be accounted for in science, nevertheless intellect can be aware of it as the realm of absolute causes, for:

> ". . . proceeding still in his [a curious inquirer] analysis and inquiry, he ascends from the sensible into the intellectual world, and beholds things in a new light and a new order, he will then change his system, and perceive that what he took for substances and causes are but fleeting shadows; *that Mind contains all, and acts all, and is to all created beings the source of unity and identity, harmony and order, existence and stability."*[41]

In this realm Berkeley has placed all intelligible order, that order which causes and organizes the observed.

From this material some light is thrown on Berkeley's theories of space and time. Although there does not seem sufficient evidence to conclude that God has Ideas of space and time nevertheless God so controls the order of the world in space and in time that this absolute order derived from God may well suggest an absolute space and absolute time. Such a conclusion, if true, has important implications for human perceptions of space and time in the sense that human perceptions of space and time bear to the Divine order and arrangement of phenomena a similar relation that the relative space and time of Newton and Locke bore to their absolutes. The world as contemplated by Berkeley's God or more exactly continually participated in and controlled, is ordered in the same absolute way that Newton hoped to achieve from a postulation of absolute masses in absolute motion. Obviously, the difference between a mechanical account such as Newton offers and the voluntaristic participation of God that Berkeley suggests is not to be understood as slight or unimportant. But this is not to deny the similarity in that Berkeley's God as cause and Newton's absolute mass as cause are those realities which in the

[39] III. 286.
[40] III. 286.
[41] III. 265. Italics mine. Cf. also III. 235–236 and III. 262.

end are called upon to explain and make plausible the existence of the phenomenal. In fact the two "worlds" are much more alike than the two "Gods." This becomes clear if we recall the relation intended by Berkeley, in his less Platonic period, between the system of God's ideas and the system of our own ideas, for:

> *". . . the things I perceive must have an existence, they or their archetypes, out of my mind,* but being ideas, neither they nor their archetypes can exist otherwise than in an understanding; there is therefore an understanding. But will and understanding constitute in the strictest sense a mind or spirit. *The powerful cause, therefore of my ideas is in strict propriety of speech a Spirit."*[42]

Here we see quite clearly asserted the belief that human ideas have an external cause in the system of ideas before the mind of God.

The space and time of which we are aware is a space and time caused by God from whom all things derive their order and existence. Such a conclusion again suggests the absolute space and time of Newton and Locke for in these men our ideas of space and time, our measures, were measures of and were caused by absolute space and time. God's Ideas become the laws governing phenomena, while man's ideas are but perceptions and images of this phenomena. In this flux of "phenomena," the relative world, man has his private time and private space. However, there is not present at the close of Berkeley's philosophy the same radical relativity which seemed most apparent in his earlier works. Our relative and private perceptions of space and time are given an order and correspondence by God. Here again seems to be drawn the old distinction on which Newton placed so much emphasis, i.e., absolute space and, "absolute, true, and mathematical time" as distinguished from relative space and, "relative, apparent, and common time."

It is obvious of course that there are still great differences between the cosmologies of Berkeley and Newton, a difference that is implicit both in their treatment of space and time, e.g., in Berkeley they are a system of relations while in Newton they are immaterial substances, and in their conceptions of the nature of God and the relation of the world to God. This at once raises the question of Berkeley's metaphysical relativism as contrasted with the epistemological relativism which we have considered. This problem like the problem of mind and body does not from necessity enter into the present discussion.

[42] Dialogue. I. 453, italics mine.

CHAPTER VIII

CONCLUSION

In this examination of those theories of space and time which prevailed in England from 1648 to 1744 it has been our purpose to show the historical relationships of those theories and to note the contemporary criticisms directed toward those speculations. There has resulted from such a plan certain general conclusions which appear to be important for an understanding of the work in question. In the philosophy of Henry More we found two very notable characteristics. First, there is the compelling desire to give to the immaterial a place which is as firmly secured as the place already occupied by matter. Secondly, More attempts to establish the reality of the immaterial through changes and additions in the philosophy of Descartes. Now, as we have seen, it is just in this particular reaction to Descartes that More raises for himself problems that are of interest to this study. The change in the Cartesian philosophy is a new definition of matter, while the addition is that of extension to the spiritual. Thus the spiritual acquires for More that reality which matter has for Descartes, while through the new definition of matter More hopes to avoid an identification of matter with spirit. Seen from this point of view the speculations of More provide a logical setting for a theory of space since from the formulation of his problem he must show that space is something other than matter as extended if spirit is to be considered as real as the matter of Descartes. Consequently, it is suggested that the existence of space as a thing separate from matter and possessing properties in its own right, in the philosophy of Henry More is to be explained as the result of his interest in a theory of spirit. Furthermore, once this theory of space was advanced it was quickly broadened to include other subject matter. Most startling in this connexion is the identification of space with God's attribute of extension and the comparison of this space with the other divine attributes. We may now see in More's theory of real space the beginnings of the theory that holds space absolute and the other theory that conceives space as somehow divine. It is from this that More acquires a certain historical importance. First, he has diverged from and changed the Cartesian philosophy in such a way that even as early as 1648 English philosophy may be said to be raising new problems and attempting to solve old ones in an atmosphere that is quite its own. Secondly, we see here the beginnings of a theory of absolute space, a theory which is to have important developments until at least as late as 1744, and which is to be of particular interest to physical science. Thirdly, there has arisen the claim that space may give us knowledge of God, a claim which, as we have seen, appears in practically all of the work of this period with the exception of Berkeley and the dissenters from Samuel Clarke.

From More our attention was directed to Isaac Barrow in whose work

two results stand out rather clearly. It is Barrow who most obviously supplies a theory of time which parallels to some extent More's theory of space in the sense that Barrow concludes that time is other than the motion of bodies, that time may well be absolute, and that time has reference to God's attribute of duration. But in another respect Barrow shows a development from More for although it seems safe to say that he accepts all of More's theories, still he makes the important addition that space and time constitute the basis of measurement for science. There is present in this emphasis on space and time as real entities which are measured and which serve also as the locus of arithmetic and geometry an important forecast of how absolute space and absolute time are to be treated by physical science. We suggest that Henry More provides English thought with a theory of absolute space and in a slight measure with a theory of absolute time, although as we have seen a theory of time is more Barrow's contribution. Furthermore, from the intension of his philosophy of spirit they become absolute immaterial substances. In contrast to this we would conclude further that it is in Barrow's theories that a physical purpose is discovered for these absolute immaterial substances. They are that which is measured when we wish to find the location of an object in space or in time.

The conclusions point to what is most essential both in the actual theories of More and Barrow as well as in the contribution that these theories make to the theories that followed. It is maintained that in the work of these two men a certain divergence from Continental models is exhibited which it is important to remember in a consideration of Locke, Newton, and Berkeley.

From More and Barrow, who in a measure serve as an introduction to the period considered, we turn to the work of Newton. In the *Principia*, which we took as representing a center around which this essay was to be organized, there is implicit much of the position of More and Barrow. We find Newton building on the vaguer formulations of Henry More and Galileo, defining matter precisely as mass, rather than as extension. Also, Newton agrees with More and Barrow that space and time are absolute, and he further agrees with Barrow that absolute space and time are the entities that are measured. But it is just here in the treatment of the measures of space and time that we are compelled to recognize a new development of older theories. There is a bifurcation of space and time into absolute and relative or the thing which is measured and the measure of the thing. From this new treatment of space and time, a treatment that was implicit in Barrow, follow further ramifications of the subject. However, for the moment let us consider Newton's absolutes. On the one hand these have a history in English thought from at least 1648 until the publication of the *Principia* in 1687. Consequently, it seems safe to conclude that Newton's theory of time and space as absolutes may have been to some extent acquired from his English predecessors at Cambridge. Also, as we have tried to show on this, the historical side of the question, there is the common attitude that from absolute space and time we have manifestations of God's attributes. This is easily read in both the third edition of the *Principia* and the third edition of the *Optics*. From this aspect Newton's absolute time and space are in keeping with the tradition established by Henry More. Now in contrast to this, an historical explanation, we have the important theory of matter which Newton

develops very much by himself. It is of course true that matter had been defined in ways that were different from Descartes' definition, but in spite of this body of dissent Newton's treatment of matter as mass and the mathematics which made such treatment effective seems to be very much his own. In the definitions of matter, whether they be by Descartes or More, matter is considered as absolute in that its essence is unchanging. Assuming this Newton agrees with Descartes but differs from him concerning the differentia. As we said before it is in Newton's continuing to hold matter absolute that there is afforded the opportuntiy for another conclusion about his absolute space and time. From this approach to these entities we conclude that they are logically derived from absolute matter in that they are necessary as a locus for the changes of matter, changes which from the definition of matter must always be external to the essence of matter. Looked at in this way we believe that absolute space and time cease to be doctrines merely inherited from More and Barrow and assume a larger setting, in the attempt to make intelligible the notion of matter as absolute mass. Although it is the contention of this essay that both interpretations are valid it is felt that a qualification is needed. Alone, neither reading of Newton takes all the facts into account. Both are required, it is believed, to explain properly the origin and place of absolute space and time in the speculations of Newton; he both inherited them from previous English philosophy, and found them logically implied in his laws of motion and concept of mass.

However, as we may recall, there are also relative space and relative time. By these it seems safe to believe Newton means our measures of the absolutes. It is just in this question of measurement, a knowledge of which is our knowledge of the phenomenal world, that the question of space and time undergoes another change that brings us to the *Essay* of John Locke. Before definitely stating our results for this part of the investigation, we should recall that it is in this mediating connexion between More and Barrow on the one side and John Locke on the other side that gives the *Principia*, as read for the problems of this investigation, its significance as a work preceded by a tradition and initiating a further tradition. From the question of measurements of time and measurements of space the step seems short to the other question of the limits and extent of our knowledge of space and of time.

It was maintained that Locke's theory of knowledge could be understood as requiring three terms or sets of entities, mind, ideas, and scientific objects. The first of these was not considered since it did not seem essential for our questions. The second was to be understood as comprising that which was immediately known and which was causally related to scientific objects or those entities which comprised the world of Newtonian physics. Since there is a relation between ideas and scientific objects such that knowledge of ideas is, within limits, knowledge of scientific objects, Locke's chief problem is to explain the limits and extent of knowledge in that world which Newton had described. With this epistemology as a background we examined Locke's theories of space and time and concluded that in our ideas of space and our ideas of time we had a space and a time which perform two functions. In the first place, such ideas of space and time afford us knowledge of space and time and from this point of view are analogous to the relative or measured time and space of Newton's *Principia*.

Secondly, this time and space is the locus of that class of entities which Locke calls ideas; our ideas are to be understood as placed in the time and space of which we have an idea. But as we have already seen ideas are related to a class of objects which are their causes. In this way, we believe, Locke continues the bifurcation of space and time, for that to which our ideas of space and time have reference is absolute space and time, the very space and time in which are placed the class of entities which form the objects of science. Furthermore, there seem discernible two hints of how Locke would have this scientific space and time understood. First, there is the treatment of the modes of our simple ideas of space and time which from the definition of mode might suggest that space and time as absolutes are substances. Secondly, there is present the predilection to think of absolute space and time as of divine significance. For these reasons the conclusion is suggested that Locke is closely related to Newton in his treatment of space and time since there persists even more clearly the dualism of absolute and relative, the purpose of the dualism being an explanation of how Newton's world can be known.

At this point the logical development of the theories in question was interrupted by an account of those implications of the theories of space and time which might be called theological. From 1648 to the publication of Locke's *Essay* in 1680 it has been our purpose to note that in practically all of the men considered there were varying degrees of alliance between space and time and God's attributes of extension and duration. With the publication in 1731 of Law's translation of King's *Origin of Evil* a discussion began, the immediate purpose of which was to show that any theory of space or time which connected these entities with God's attributes was false. On the other hand, the older tradition was defended and we found it reasserted that space and time were related to God. We believe it fairly clear that, although the immediate subject matter of the dispute was space and time, in fact the issues debated were somewhat more inclusive. That is, the group of men who defended the relation of space and time to God's attributes were of the opinion that God's nature was such that His attributes were subject to logical description and deduction. If this is true they may have believed further that in identifying the attributes of God with those entities which played such an important part in the new science they increased the intelligibility and certainty of our knowledge of God. Again it must be recalled that from Newton's *Principia* the seventeenth and eighteenth centuries derived a cosmology that admitted of no doubt or question. If it could be shown that the very space and time which was the framework of that cosmology was divine then the claims of religious philosophy and the claims of natural philosophy were reconciled. On the other hand, we may take the dissenters from this opinion as insisting that God's nature is such that it is not open so fully to rational discourse or discussion. The nature of God is moral and to attempt any explanation of this fact is to miss the point, how much worse is it then to formulate this in the terms current for science.

After an account of this conflict of science and religion which confines the disagreement to theories of space and time we returned to the more logical developments of Locke and Newton's theories of space and time as these are found in the works of George Berkeley.

In treating of Berkeley the most favorable approach was afforded through the *Commonplace Book* since here is found not only a remarkable synopsis of Berkeley's philosophy but also his first remarks on space and time. At the beginning it was maintained that Berkeley's theory of knowledge was an example of the application of Occam's razor to Locke's *Essay*. In accordance with this interpretation we found that from a three-term theory of knowledge we were reduced to a two term. Our subjects of discourse were minds and ideas.

In this examination the conclusion was drawn that the objects perceived immediately constitute our sole reality so that in our perceptions of space and time we have knowledge of the only space and time intelligible for our minds. Consequently, Berkeley's theory of knowledge was denoted monistic since there is no longer the dualism of ideas and scientific objects or the dualism of absolute and relative space and time. This monism was denoted relativistic to distinguish it from Locke's relational theory since our perceptions are relative to us and are not related to an assumed world of scientific objects. Thus it seemed safe to believe that Berkeley recognized nothing but a perceived space and time and that finally the absolute space and time which had its origin in More nearly a century before had been discarded from English philosophy. It became necessary at this point in the discussion to consider the part that God played in the system. On this point the position defended was that Berkeley's God not only had Ideas but was the cause of our ideas. In the relation that the world bore to God there seemed strong reason to believe that it was from God that the world derived its order and consistency. Such an addition to Berkeley's philosophy made important changes in his theory of knowledge, for our knowledge is no longer to be limited to perceptions and the resultant ideas, but is to include notions or knowledge of God's Ideas. The earlier proposition that *esse* is *percipi* tells but part of the truth for we must consider another proposition, i.e., *esse* is *intelligi*. God plays an indispensible part in Berkeley's system and of God's knowledge we have a dim and faint understanding since we are able to conceive of God's Ideas although our perceptual knowledge is not of a kind that can ever include knowledge which has been placed on the conceptual level. From this material the opinion was advanced that although the evidence was lacking for Ideas of space and time before God's mind, nevertheless Berkeley by attributing the order and arrangement of the world to God had to some extent introduced Newton's absolute time and absolute space. In a measure, at the end of our study we see reaffirmed the dualism of absolute and relative for although the "Gods" of Newton and Berkeley are very different the kind of worlds are rather similar.

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VITA

John Tull Baker was born at Baltimore, Maryland, in 1904. He was graduated from the Johns Hopkins University, with the degree of Bachelor of Arts, in 1925. He studied philosophy at that university from 1925 to 1928, and at Columbia University from 1928 to 1930.

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